NEP 2020 ALIGNED OBE CURRICULUM

PROGRAM: DIPLOMA IN CIVIL ENGINEERING

by

Curriculum Development Cell,

Government Polytechnic, Nagpur

Document Written by

Dr. G.V. Gotmare

I/C Curriculum Development Cell

Government Polytechnic, Nagpur, India

Curriculum Developed by

Faculties and Experts (Mentioned in individual curriculum)

Approved by

Advisory Board (AB),

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And

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Government Polytechnic, Nagpur

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Dr. R. P. Mogre

Principal,

Government Polytechnic, Nagpur, India

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The Program Structure and Curriculum Contents for Diploma in Civil Engineering are approved in Program-wise Board of Studies (PBOS) of Civil Engineering, Board of Studies (BOS), and Governing Board (GB), of Government Polytechnic, Nagpur.

(Dr. D. K. Parbat)
Head of Deptt.
Civil Engineering
and
Chairman PBOS (CE)

(Dr. G.V.Gotmare)
In-charge
Curriculum Development Cell
and
Member Secretary PBOS (EE)

(Dr. R.P.Mogre)
Principal
Government Polytechnic, Nagpur, India

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10.	Dr. R.V.Yenkar	Member	HOD, Electronics & Tele. Comm. Engineering, Government Polytechnic, Nagpur
11.	Dr. G.K.Awari	Member	HOD, Automobile Engineering, Government Polytechnic, Nagpur
12.	Dr. G.K.Parbat	Member	HOD, Civil Engineering, Government Polytechnic, Nagpur

13	Dr. A. R. Umale	Member	HOD, Mechanical Engineering, Government Polytechnic, Nagpur
	Mr. S. R. Kaduskar	Member (till 24/09/2024)	I/C HOD, Mechanical Engineering, Government Polytechnic, Nagpur
	Dr. S. S. Baraskar	Member (till 31/03/2024)	I/C HOD, Mechanical Engineering, Government Polytechnic, Nagpur
	Mr. Y. K. Gaiky	Member (till 31/10/2023)	I/C HOD, Mechanical Engineering, Government Polytechnic, Nagpur
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6	Mr. N.J.Burbure	Member (Institute)	Lecturer in Mechanical Engineering, Government Polytechnic, Nagpur
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4	Mr. M.N.Gawande	Member (MSBTE Nominee)	Lecturer in Electrical Engineering, Government Polytechnic, Gondia
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	Mrs. A.A.Alegaonkar	Member (Institute) (till 19/12/2024)	Lecturer in Electrical Engineering, Government Polytechnic, Nagpur
6	Mr. A.P.Dasarwar	Member (Institute) (till 19/12/2024)	Lecturer in Electrical Engineering, Government Polytechnic, Nagpur
	Mrs. A.P.Gandhi	Member (Institute)	Lecturer in Electrical Engineering, Government Polytechnic, Nagpur
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5	Dr. M.N.Bawane	Member (Institute)	Lecturer in Electro. & Telecom, Government Polytechnic, Nagpur
6	Mrs. U.M.Ramteke	Member (Institute)	Lecturer in Electro. & Telecom, Government Polytechnic, Nagpur
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3	Dr. Rakesh Kadu	Member (Academic)	Assistant Professor, in IT, Ramdeobaba College of Engg. Nagpur
4	Mrs. V.A.Raje	Member (MSBTE Nominee)	System Analyst, MSBTE, RO, Nagpur
5	Ms. D.P. Chanmanwar	Member (Institute)	Lecturer in IT, Government Polytechnic, Nagpur
	Mr. L.D.Vilhekar	Member (Institute) (Till 19/12/2024)	Lecturer in IT, Government Polytechnic, Nagpur
6	Ms. Shifa Syed	Member (Institute)	Lecturer in IT, Government Polytechnic, Nagpur
	Ms. Isha Lokhande	Member (Institute) (Till 19/12/2024)	Lecturer in IT, Government Polytechnic, Nagpur
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List of contributors for curriculum development

Sr. No.	Name of Faculty	Designation
Civil Engineering		
1	Dr. D. K. Parbat	HOD, Civil Engineering (Section –A)
2	Dr. A. W. Pawde	HOD, Civil Engineering (Section –B)
3	Dr. S. R. Kukadapwar	HOD, Applied Mechanics
4	Mr. S. K Rangari	Lecturer in Civil Engineering
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14	Mrs. N. K. Deshmukh	Lecturer in Civil Engineering

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FOREWORD- Chairman Governing Board

Dr. Vinod Mohitkar
Chairman, Governing Board
&
Director, Technical Education, Mumbai

It is with immense pride and a deep sense of purpose that I present the *NEP aligned 2023 Curriculum for Diploma in Engineering*, a landmark step in advancing technical education. As Chairman of the Governing Board of Government Polytechnic, Nagpur and Director of Technical Education, Maharashtra State, I consider this curriculum a reflection of our collective commitment to the transformative vision laid out in the National Education Policy (NEP) 2020.

This curriculum embraces the core principles of Outcome-Based Education (OBE) and integrates the modern educational framework of Bloom's Taxonomy, focusing on equipping students with future-ready skills, practical knowledge, and professional competencies. Designed to foster innovation, critical thinking, and a hands-on learning approach, it addresses the rapidly evolving needs of industries and communities alike.

I wish to place on record my sincere appreciation for the Board of Studies Chairman and all Board of Studies members, whose leadership, insight, and dedication played a pivotal role in shaping this curriculum. Special thanks are also due to the Principal, Heads of Departments (HODs) and faculty members of various programs who actively contributed by

sharing ground-level teaching insights, refining course content, and ensuring alignment with real-world applications. Their collaborative efforts with the Program-wise Board of Studies academic and industry experts, who brought in valuable field experience, ensured that the curriculum remained dynamic, relevant, and future-oriented.

Through multiple rounds of consultations, workshops, and rigorous reviews, the curriculum has evolved to incorporate sector-specific innovations, practical implementation pathways, and learner-centric strategies. The collaboration between academia and industry—spearheaded by the Boards of Studies—has ensured that the curriculum is not only academically robust but also aligned with current industry standards and future demands.

This curriculum document, including chapters on NEP 2020, OBE philosophy, SWOT analysis, and curriculum development methodology, along with more than 50 carefully curated course curricula of each program, stands as a testimony to the vision and meticulous planning behind this academic reform.

I am confident that *Curriculum 2023* will serve as a cornerstone for excellence in technical education. It is our collective responsibility to implement it with the same spirit of dedication that guided its creation, as we work toward nurturing a generation of skilled, thoughtful, and responsible technocrats.

(Dr. Vinod Mohitkar)
Chairman, Governing Board, Government Polytechnic, Nagpur
and Director, Technical Education, Maharashtra State.

FOREWORD- Past Member Secretary Governing Board

Dr. Manoj Daigavane
Ex. Member Secretary, Governing Board,
Government Polytechnic, Nagpur &
Jt. Director, Technical Education, R.O. Nagpur

It is with immense pride and a deep sense of accomplishment that I pen this foreword for the revised NEP aligned curriculum document of Government Polytechnic, Nagpur. Having had the privilege to serve as the Member Secretary when the journey of aligning our educational framework with the transformative vision of the National Education Policy (NEP) was first initiated, I witnessed firsthand the dedication and foresight that has culminated in this comprehensive and forward-thinking curriculum.

The landscape of technical education is ever-evolving, and the NEP 2020 has provided a robust framework for fostering holistic, multidisciplinary, and skill-oriented learning. This curriculum document is a testament to our institution's commitment to embracing these progressive ideals. It meticulously integrates key NEP principles, ensuring that our students are not only academically proficient but also adaptable, innovative, and socially responsible citizens ready to contribute meaningfully to the nation's growth.

A cornerstone of this revision has been the unwavering focus on Outcome-Based Education (OBE), meticulously structured around the principles of Bloom's Taxonomy. This ensures that every learning experience is purposeful, with clearly defined outcomes that empower students to

acquire not just knowledge, but also critical thinking, problem-solving, and practical skills. The shift towards an outcome-centric approach will undoubtedly enhance the quality of learning and prepare our graduates for the complex demands of the 21st-century workforce.

The development of this curriculum has been a truly collaborative endeavor, embodying the spirit of collective expertise. The rigorous curriculum development process, involving extensive deliberations, workshops, and feedback sessions, has been instrumental in shaping this document. This curriculum is a testament to collaborative effort. My sincere gratitude goes to the distinguished experts and dedicated faculty, especially the In-charge of the Curriculum Development Cell, who spearheaded the writing of various chapters, ensuring their depth and relevance. Their tireless work has been instrumental.

As the Ex. Member Secretary of the Governing Board, Government Polytechnic, Nagpur, the supreme authority for curriculum approval, I can attest to the thorough scrutiny and thoughtful consideration given to every aspect of this revision. We are confident that this new curriculum will not only uphold the high standards of academic rigor that Govt. Polytechnic, Nagpur is known for, but also empower our students to become lifelong learners and leaders in their chosen fields.

I commend everyone involved in this monumental undertaking. This curriculum is a beacon guiding our students towards a brighter future, and I am confident it will contribute significantly to their personal and professional growth, and ultimately, to the progress of our nation.

[Dr. M. B. Daigavane]
Ex-Member Secretary, Governing Board,
Government Polytechnic, Nagpur

FOREWORD- Member Secretary Governing Board

(Dr. R.P.Mogre)
Member Secretary, Governing Board
&
Principal, Government Polytechnic, Nagpur

It gives me immense pleasure to present this comprehensive curriculum document developed by our autonomous polytechnic, a result of collaborative academic vision, pedagogical advancement, and policy alignment. This curriculum reflects a strategic response to the National Education Policy (NEP) 2020, integrating its transformative vision into technical education.

The document outlines the systematic curriculum development process, beginning with institutional introspection through SWOT analysis and guided by the principles of Outcome-Based Education (OBE). The integration of Bloom's Taxonomy ensures that the curriculum targets holistic cognitive development, fostering analytical, creative, and application-level competencies in students.

The curriculum has been developed by teams of experienced faculty members and subject experts under the guidance of the In-charge of the Curriculum Development Cell. Their efforts were directed toward making the curriculum learner-centric, industry-responsive, and future-ready. Notably,

the design process included inputs from domain specialists and industry professionals previously associated with our Program-wise Board of Studies and Board of Studies, ensuring both academic relevance and industrial applicability.

As the Member Secretary of the Governing Board—the apex academic authority for curriculum approval—I take pride in acknowledging the tireless dedication and academic integrity with which this document has been developed and approved. I am confident that this curriculum will serve as a robust foundation to produce competent, ethical, and innovative diploma professionals aligned with national aspirations.

(Dr. R.P. Mogre)
Member Secretary,
Governing Board, Government Polytechnic, Nagpur
&
Principal, Government Polytechnic, Nagpur

FOREWORD- Member Secretary, Board of Studies

Mr. Sudhir P. Pathak
Chairman, Board of Studies
Government Polytechnic, Nagpur

It gives me immense pleasure to present the NEP aligned 2023 Curriculum for the Diploma in Engineering, developed at Government Polytechnic, Nagpur.

As a Chairman of the Board of Studies and with the background of having served in Engineering and Auto industry for several decades, I deeply recognize the need for a dynamic, responsive, and industry-aligned technical education framework. This curriculum is a forward-looking document, inspired by the National Education Policy 2020 and built upon the principles of Outcome-Based Education (OBE).

The demands of the modern industrial landscape viz. digital transformation, sustainability, automation, global competitiveness, et al. requires diploma engineers who are not just technically competent but also, innovative, versatile, resourceful, and ethically grounded. This curriculum assuredly reflects those very values. It is designed with inter and intra institute deliberations and with careful consideration to the needs of students, industry, and society as well. It integrates modern pedagogical approaches such as Bloom's Taxonomy, continuous curriculum enhancement through SWOT analysis, and comprehensive assessment techniques. It also emphasizes skill development, entrepreneurship, and holistic learning

through internship and industry interaction and fosters a vibrant academic environment, ensuring that students graduate with the competencies required in the 21st-century workplace.

The Board of Studies has worked collaboratively with faculty, industry experts, alumni, and academic leaders to ensure that every course and learning outcome is relevant and robust.

I commend the entire curriculum development team for their assiduous efforts and dedication to excellence. Their work marks a significant step toward creating technically sound, socially responsible, and globally employable engineers. I am confident that this document will serve as a strong foundation for academic delivery and industry collaboration in the years to come.

Let us continue to inspire, evolve and, innovate building a stronger future for technical education in India.

[Sudhir P. Pathak]

Chairman, Board of Studies, Government Polytechnic, Nagpur

Preamble

The 2023 Curriculum of Government Polytechnic, Nagpur for the Diploma in Engineering reflects a transformative shift in technical education, firmly rooted in the Outcome-Based Education (OBE) framework, and aligned with the visionary directives of the National Education Policy (NEP) 2020. This curriculum has been thoughtfully designed to respond to the changing educational landscape, technological advancements, and evolving industry requirements, with a strong focus on practical skills, flexibility, and holistic development.

Our institute, renowned for its commitment to excellence in technical education, continues to play a vital role in shaping competent professionals who contribute meaningfully to national development. Through the modernization and continuous refinement of our academic offerings, we aim to empower students with the skills, attitudes, and knowledge necessary for lifelong success. Our focus has always remained on innovative, learner-centered curriculum development, emphasizing both technical competence and personal growth.

In line with NEP 2020 reforms, the revised curriculum embraces several key features: a choice-based credit system, multiple entry and exit options, skill-based education, soft skill and industry internship, and value-based education. These features not only support multidisciplinary learning but also foster creativity, critical thinking, and ethical responsibility among students.

The curriculum revision process was undertaken through a highly participative and structured approach. Valuable inputs were gathered from a wide spectrum of stakeholders, including industry experts, alumni, academic leaders, and students, ensuring the curriculum remains relevant, responsive, and forward-looking. Guided by the Governing Board (GB), Board of Studies (BOS), Program-wise Board of Studies (PBOS), and the Curriculum

Development Cell (CDC) of the institute, played integral roles in shaping this document. The contributions of faculty members, Heads of Departments (HODs), and domain experts further enriched the content and ensured alignment with the latest technological and pedagogical standards.

The implementation of OBE principles ensures clarity in learning outcomes, structured assessment strategies, and continuous improvement through feedback and evaluation. The integration of Bloom's Taxonomy, domain-specific learning objectives, and a clearly defined assessment framework supports differentiated learning across cognitive, affective, and psychomotor domains. A SWOT analysis methodology was employed to identify program-level strengths, gaps, opportunities, and challenges—laying the foundation for robust and future-ready program structures.

The NEP aligned 2023 curriculum offers a balanced and flexible learning scheme incorporating classroom instruction, laboratory experience, tutorials, and self-directed learning. Innovative elements such as skill enhancement courses, value education, NPTEL and Spoken Tutorial integration, and notional hour calculation reflect the comprehensive nature of the new academic structure.

Our institutional vision is to emerge as a Center of Excellence in technical education, committed to nurturing innovation, employability, and entrepreneurship. The NEP aligned 2023 Curriculum is a significant milestone in our academic journey, reinforcing our legacy of quality and our dedication to continuous educational advancement. It sets the stage for dynamic, student-centric learning environments that inspire students to contribute actively to society and industry.

[Dr. G. V. Gotmare]
Member Secretary, Board of Studies &
I/C, Curriculum Development Cell, Government Polytechnic, Nagpur

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CHAPTER 1

Introduction

This chapter describes the history, organization structure, curriculum development system and the various bodies responsible for the development of curriculum of Government Polytechnic, Nagpur (GPN).

1.1 History

The Government Polytechnic, Nagpur, stands as one of the oldest technical institutions in central India. Established on July 14, 1914, it began as the Government Engineering School. Initially housed in the Victoria Science College (currently the Institute of Science), the institution started with just 16 students. In its inaugural year, it offered diploma-level courses in Civil and Mechanical Engineering. By 1915, an Automobile Engineering course was introduced, which later evolved into a Post Diploma program in Automobile Engineering. The institution played a pivotal role in the establishment of what is now the Visvesvaraya National Institute of Technology (VNIT), Nagpur. Over the years, the institution experienced significant growth, expanding from its modest beginnings to an enrollment of nearly 2,000 students today. The Government Engineering School was eventually renamed Government Polytechnic, Nagpur.

1.1.1 Autonomy

The Institute recently commemorated its centenary, celebrating 111 years of outstanding contribution to technical education. Government

Polytechnic, Nagpur has a rich history of evolving to meet the needs of industry and society. The institution remains committed to addressing the educational demands of an ever-changing world.

In 1995, the Government of Maharashtra granted the institute autonomous status under Government Resolution No. WBP-1093/(2640) (69)VE-5, dated March 31, 1994. This autonomy empowered the institute to independently introduce new programs, design curricula, implement self-developed academic plans, and oversee the assessment, evaluation, and certification of students.

1.1.2 Awards

Some of the prestigious awards received by Government Polytechnic, Nagpur are as follows:

- State Award "Best Overall Performance 1996" (ISTE Narsee Monjee Award)
- State Award "Best Polytechnic, 1997" , (Govt. of Maharashtra)
- National Awards "Best Polytechnic, Student Chapter 2002", (Institute of Engineers (India))
- National Awards "Best Polytechnic, Student's Project ,2002" (ISTE Narsee Monjee)
- State Award "Best Overall Performance 2016" (ISTE Narsee Monjee Award)
- National Education Award for "Best Technical Educational Institute in Maharashtra State-2016"

1.1.3 Geographical Location

Nagpur, located in India, lies at a latitude of 21.146633 and a longitude of 79.088860. Its geographical coordinates are 21° 8'

47.8788'' N and 79° 5' 19.8960'' E. The city sits at an elevation of 311 meters above sea level and is positioned at the very center of the Indian subcontinent. As shown in Figure 1.1, Nagpur is home to the Zero Mile Stone, a landmark that historically marked the geographical center of India and was used by the British to measure distances across the Indian subcontinent. The city's name is derived from the Nag River, which flows through it, originating from a village named Lavha. Nagpur is renowned for its oranges, often referred to as "Nagpur oranges," and has earned the title of the "Orange City" due to its prominence as a major trading hub for the region's orange cultivation.

Figure 1.1. Location of Nagpur City

1.1.4 Campus

Government Polytechnic, Nagpur is situated in heart of the Nagpur City at "Sadar" area, 2.1 km walking distance from zero-mile stone as well as Nagpur railway station.

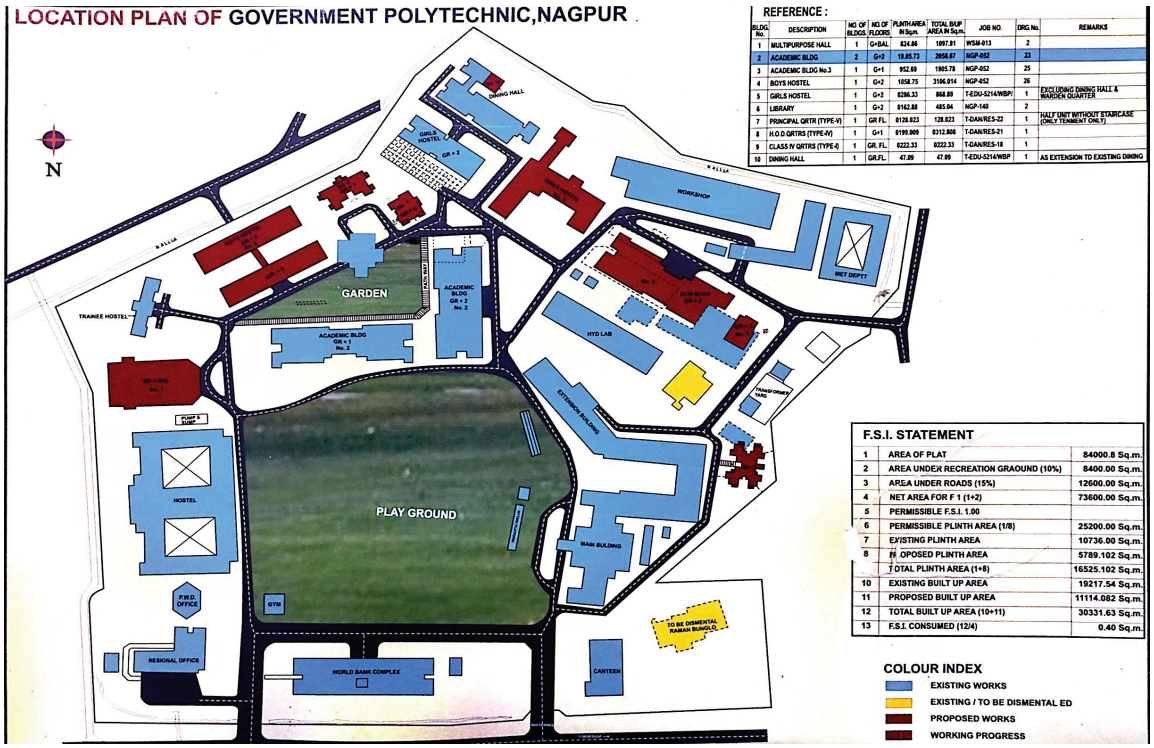

Figure 1.2. Government Polytechnic, Nagpur Campus

1.2 Organizational Structure

GPN, as a part of the Polytechnic Education System, has been addressing the needs of individuals, the community, society, and industry for over 111 years. Until 1995, its services operated under various affiliations, including the university, MP DTE, and MSBTE.

In 1995, the Government of Maharashtra granted GPN autonomous status. This autonomy empowered the institute to independently manage academic matters such as identifying the need for new

programs, designing requisite curricula, implementing self-designed curricula, and conducting student assessment, evaluation, and certification. In essence, the institute became fully accountable for these academic responsibilities, including facilitating student placements in the workforce.

To ensure effective and efficient operations under autonomous status, a functional organization was established alongside the institute's hierarchical structure, enabling streamlined management and governance.

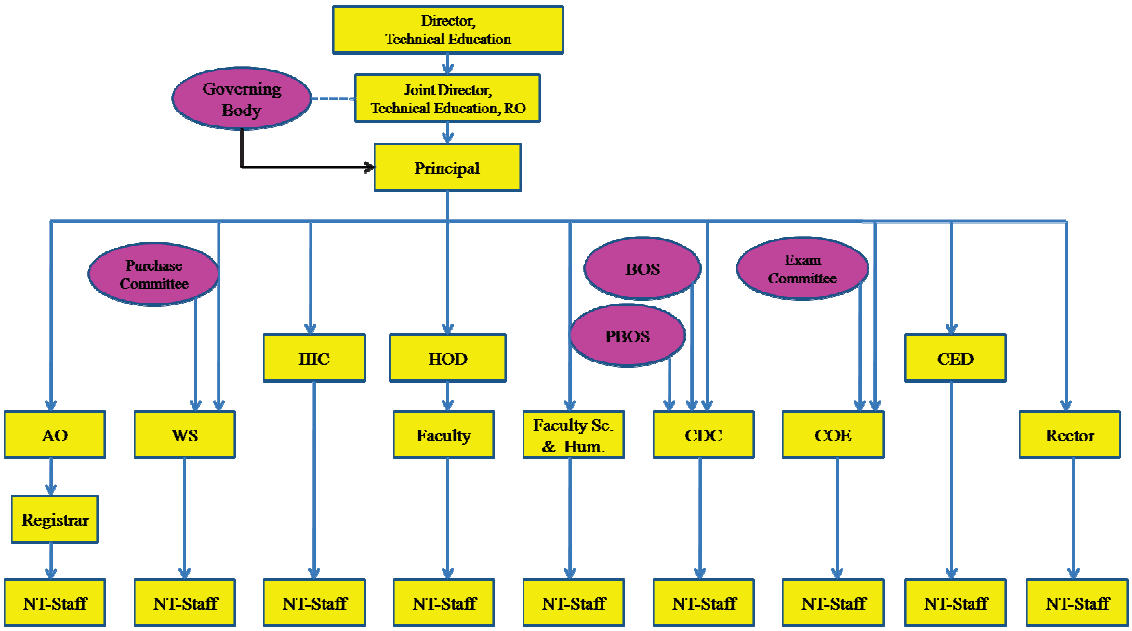

Figure 1.3. Organizational Structure of GPN

1.3 Curriculum Development System

Since 1995, the institute has been independently designing, revising, and implementing curricula for all programs under its autonomous status, except for Mining and Mine Surveying. This process is carried out using the Curriculum Development System illustrated in the accompanying figure 1.4.

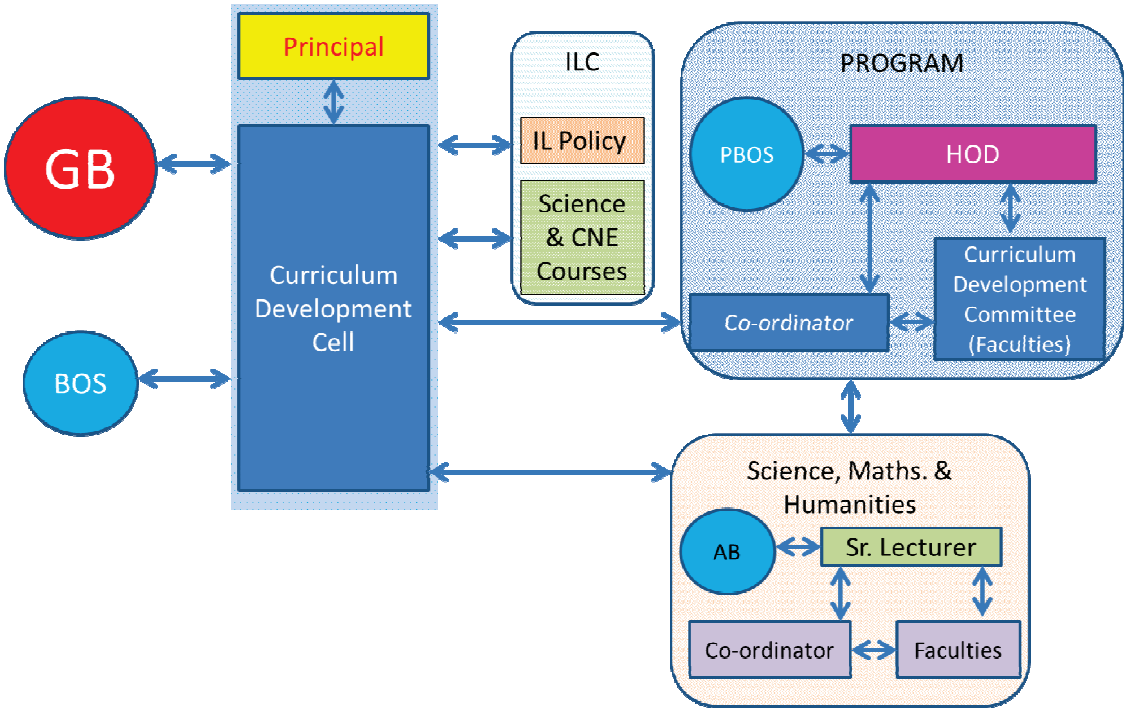

Figure 1.4. Curriculum Development System

The Curriculum Development System comprises various entities, including Program Departments (such as Civil, Mechanical, and Electrical), Non-Program Departments (such as Science, Mathematics, and Humanities), the Institute Level Committee (ILC), and the Curriculum Development Cell (CDC), which is headed by the Principal of the Institute. The institute follows a systematic process for designing, revising, developing, implementing curricula, and assessing and evaluating students to enhance their learning outcomes.

Constitutional bodies, such as the Governing Body (GB), Board of Studies (BOS), and Program-wise Board of Studies (PBOS) for specific programs, along with the non-constitutional Advisory Board (AB) for Non-Program Departments, are responsible for curriculum approval.

This section outlines the philosophy underpinning curriculum design, the mechanisms for its implementation, and the approach adopted for assessing student performance.

1.3.1 Governing Board (GB)

The Governing Body (GB) serves as the apex authority of GPN. Below is a detailed outline of its committee members, along with their roles and responsibilities.

- **Committee Members:**

1. Joint Director of Technical Education Maharashtra State, Bombay - Chairman
2. Nominee from Western Regional Committee Govt. of India - Member
3. Regional Officer, Human Resource Development or Co-ordinator, TTTI, Pune - Member
4. Representative from the Local Centre the I.E.(India) - Member
5. Representative from the Engineering Association - Member
6. Representative from the District Industries - Member
7. Project Director, State Project Implementation Unit (World Bank) – Member
8. Principal of the Polytechnic – Member Secretary

- **Functions and Responsibilities:**

1. To decide the policy of the institute and decide guidelines of the function of various committees.
2. To analyse all issues and provide policy directive for developing the scheme and implementing it at the institute level.

3. To appoint the various committees of Governance for smooth functioning of the Institute.
4. To institute scholarships fellowships studentships, Mudat prize and certificates on the recommendation of Board of Studies.
5. Approve new programmes of studies leading to Diploma/Post-Diploma.
6. Approve modifications in present curriculum in order to meet the changed demands of the industry society from time to time.
7. Approve Annual Reports of the Institute.
8. Approve Continuing Education Programmes or similar Activities Beneficial to the Students/Community Institute.
9. To approve the fees and other charges payable by the students of the Polytechnics on the recommendation of Board of Studies.

1.3.2 Board of Studies (BOS)

The Board of Studies (BOS) functions as an institute-level committee at GPN. The composition of its members, along with their roles and responsibilities, is detailed below.

- **Committee Members:**

1. Representative of the Industry - Chairman
2. Head of Department of 5 Programmes - Member
3. Local Experts of 5 Programmes- Member
4. Nominee of Board of Technical Examinations, M.S. Bombay- Member
5. In-charge of Curriculum Development Component– Member Secretary

- **Functions and Responsibilities:**

1. To prepare Syllabi for various courses and develop curriculum keeping in view the objectives of the Institute and the national requirement for consideration. Syllabi shall be equivalent to Syllabi of Board of Technical Examinations.
2. To suggest methodologies for innovative teaching and evaluation techniques.
3. To Co-ordinate research teaching, extension, and other academic activities in the various departments/ institute.
4. To recommend books including test books for various courses of studies.

1.3.3 Program Wise Board of Studies (PBOS)

The Program Board of Studies (PBOS) is a program-specific committee, with GPN comprising 13 PBOS committees. The composition of its members, along with their roles and responsibilities for each program, is outlined below.

- **Committee Members:**

1. Head of the Department concerned- Chairman
2. Two Senior Lecturers- Member
3. One expert in the programme from the neighbouring institution - Member
4. Nominee from the Board of Technical Examinations Bombay - Member
5. One Expert from the local industry in each Programme – Member
6. In-charge of Curriculum Development component - Member-Secretary

- **Functions and Responsibilities:**

1. To decide Philosophy of curriculum design course wise.
2. To analyse present needs and to identify desirable changes, additions, deletions course-wise.
3. Analyse of personnel development.
4. Formation of Programme objectives.
5. Selection of contents.
6. Design of student's evaluation.
7. To decide resources required and development thereof.
8. To decide strategy of implementation.
9. Recommend equivalence for granting exemptions.

1.3.4 Advisory Board (AB)

The Non-Program Departments (Science, Mathematics, and Humanities) do not have PBOS as per the Government Resolution. Instead, an Advisory Board (AB) has been constituted to function similarly to PBOS for these departments. There are four ABs, one each for the Physics, Chemistry, Mathematics, and English Departments.

1.4 Outline of Document

This document comprises nine chapters, each covering a key aspect of curriculum development at GPN:

Chapter 1 provides an overview of GPN, its organizational structure, and the curriculum development system.

The key provisions of NEP 2020 and relevant Government Resolutions (GR) issued by the Government of Maharashtra are examined in Chapter 2.

A detailed discussion on the principles and implementation of Outcome-Based Education (OBE) is presented in Chapter 3.

Chapter 4 focuses on Bloom's Taxonomy and its significance in designing effective learning outcomes.

A structured approach to conducting a SWOT analysis is outlined in Chapter 5.

The process for revising the 2023 curriculum is comprehensively detailed in Chapter 6.

Chapter 7 highlights the key features of an NEP 2020-aligned curriculum at GPN.

Detailed course curriculum content is presented in Chapter 8.

The complete curriculum document, along with comprehensive descriptions, is compiled in Chapter 9, while the appendix provides course-specific details.

.

CHAPTER 2

National Education Policy 2020

The National Education Policy (NEP) 2020 aims to revolutionize India's education system for the 21st century by fostering holistic learning, inclusivity, and global competitiveness. Key reforms include flexible learning pathways, vocational integration, and a focus on research and sustainability. This chapter explores these features, highlighting their impact on engineering education and India's evolution into a vibrant knowledge society.

2.1 NEP 2020: Reforms in Education System

The National Education Policy (NEP) 2020 is a landmark reform in India's educational landscape, promising transformative changes to prepare students for the 21st century and beyond. Rooted in Indian ethos, NEP 2020 aspires to create a knowledge society by ensuring high-quality, inclusive, and equitable education for all. It emphasizes holistic development, employability, and international competitiveness while maintaining alignment with India's traditions, culture, and value system.

2.1.1 Pillars of NEP

NEP 2020 is built on five foundational pillars:

- **Access**: Ensuring education is available to all.
- **Equity**: Bridging disparities across regions and communities.
- **Quality**: Enhancing educational standards to global levels.

- **Affordability**: Making education economically accessible.
- **Accountability**: Promoting transparency and efficiency.

2.2 Features of NEP 2020

The NEP 2020 emphasizes holistic and multidisciplinary learning, flexible academic pathways with multiple entry and exit options, and the integration of vocational education for skill development. Following paragraph describes these features.

2.2.1 Holistic and Multidisciplinary Learning

NEP 2020 emphasizes a multidisciplinary approach, enabling students to explore diverse subjects beyond their core disciplines. For engineering students, this approach:

- Encourages creativity, critical thinking, problem-solving, and digital literacy.
- Allows for degree customization with minors in humanities, social sciences, or management, complementing technical expertise.
- Offers options for degrees with research, honors, or dual specializations.

2.2.2 Multiple Entry and Exit Options

The policy introduces flexibility in education:

- **Stages of Certification**: Students can receive certificates, diplomas, or degrees based on their level of completion, ensuring recognition at every stage.
- **Academic Bank of Credits (ABC)**: Facilitates credit accumulation and transfer across institutions.

- **Lifelong Learning**: Enables students to re-enter education at any stage for skill enhancement.

2.2.3 Education in Mother Tongue/Local Language

Promoting instruction in regional languages enhances comprehension, retention, and communication, fostering a deeper connection to cultural roots.

2.2.4 Flexibility and Choice-Based Credit System (CBCS)

NEP 2020 introduces CBCS to:

- Allow students to tailor their learning paths.
- Enable deeper exploration of specialized areas or interdisciplinary studies.
- Support internships and research projects for hands-on skill development.

2.2.5 Vocational Education and Skill Development

Integrating vocational education ensures:

- Alignment with industry needs.
- Access to skill-based courses, apprenticeships, and collaborations.
- Graduates are both academically proficient and industry-ready.

2.2.6 Research and Innovation Ecosystem

The policy fosters a culture of research and innovation by:

- Encouraging institutes to establish research parks, incubators, and technology transfer offices.
- Promoting collaboration between students and industry partners.

- Supporting commercialization of student innovations.

2.2.7 Emphasis on Ethical and Sustainable Practices

Engineering curricula under NEP 2020 incorporate ethics, environmental studies, and social responsibility. This equips students to:

- Tackle societal challenges like climate change and resource scarcity.
- Develop solutions that prioritize sustainability and equity.

2.2.8 Global Exposure and Collaboration

NEP 2020 encourages:

- Internationalization through partnerships, exchange programs, and joint research.
- Exposure to diverse cultures and advanced technologies, enhancing global competence.

2.2.9 Gradual De-affiliation from Universities

The policy advocates autonomous institutions, allowing them to develop independent academic frameworks and standards.

2.3 Implementation of NEP 2020 in Engineering Institutes

A flexible credit framework, detailed in Maharashtra Government's GRs dated July 4 and August 3, 2023, mandates NEP-aligned curricula from AY 2023-24 for autonomous institutions and AY 2024-25 for affiliating institutions.

2.3.1 Key Highlights of the GoM GR

1. **Multiple Entry and Exit Options**
    - Certificates, diplomas, and degrees are awarded at progressive stages.
    - Holistic and multidisciplinary education is facilitated, with major and minor subject combinations.
2. **Choice of Major and Minor Subjects**
    - Students must complete a minimum of 50% credits in core subjects.
    - Options for multidisciplinary minors and honors degrees are provided.
3. **Indian Knowledge Systems (IKS)**
    - Integration of IKS courses promotes interdisciplinary research and societal applications.
4. **Academic Bank of Credits (ABC)**
    - Enables credit transfer and mobility within the education system.
5. **Outcome-Based Curriculum**
    - Designed per international standards, focusing on learning outcomes and assessments.
6. **Strengthening Industry-Academia Linkages**
    - Emphasizes internships and apprenticeships, fostering collaboration with industries.
7. **Key Result Areas (KRAs)**
    - Institutions are advised to implement KRAs for the successful execution of NEP 2020.

2.4 Conclusion

The NEP 2020 is a transformative step toward reimagining India's education system. It not only addresses the present educational challenges but also paves the way for creating a globally competent, ethically grounded, and environmentally conscious workforce. For engineering students, it opens doors to multidisciplinary learning, research opportunities, and industry alignment, equipping them to meet the demands of a dynamic global landscape.

CHAPTER 3

OBE Approach in Curriculum Design

Outcome-Based Education (OBE) focuses on achieving specific learning outcomes to meet real-world demands. It emphasizes skill development through learner-centric methods, preparing students for modern challenges. OBE ensures quality education aligned with accreditation standards and societal needs, fostering holistic student growth. This chapter describes some aspect of OBE.

3.1 Introduction to OBE

Outcome-Based Education (OBE) is a transformative educational framework that prioritizes the attainment of specific outcomes or graduate attributes by students upon the completion of an academic program. Unlike traditional teacher-centric models, OBE is inherently learner-centric, emphasizing what students are expected to know, demonstrate, and achieve at the end of their learning journey. This paradigm shift ensures that educational programs align closely with the demands of industry, society, and other stakeholders.

The adoption of OBE has gained significant momentum globally due to its focus on measurable outcomes and its ability to produce graduates who are better equipped to meet real-world challenges. Recognizing its importance, the National Board of Accreditation (NBA) in India has mandated the implementation of OBE for all engineering programs seeking accreditation from 2013 onwards. By adopting the OBE model, educational institutions ensure that their programs meet international standards of quality and relevance.

3.2 Why the OBE Approach?

The NBA's emphasis on OBE stems from its fundamental focus on producing competent and industry-ready graduates. OBE shifts the focus from the teaching process to the learning outcomes, making it a student-focused model. This approach ensures that the curriculum, teaching methods, and assessments are designed to enable students to achieve predefined outcomes, thereby enhancing the overall educational experience.

Key reasons for adopting OBE include:

- **Learner-Centric Philosophy:** OBE places the student at the center of the educational process, focusing on their ability to apply knowledge and skills effectively in practical scenarios.
- **Alignment with Accreditation Standards:** As accreditation bodies like NBA prioritize OBE, its adoption is essential for programs aiming for national and international recognition.
- **Focus on Graduate Attributes:** OBE ensures that students develop specific attributes such as critical thinking, problem-solving, communication, teamwork, and ethical responsibility, which are crucial for success in their careers.

3.3 Outcome-Based Education

The framework required for implementation of OBE consists of the following as shown in Figure:

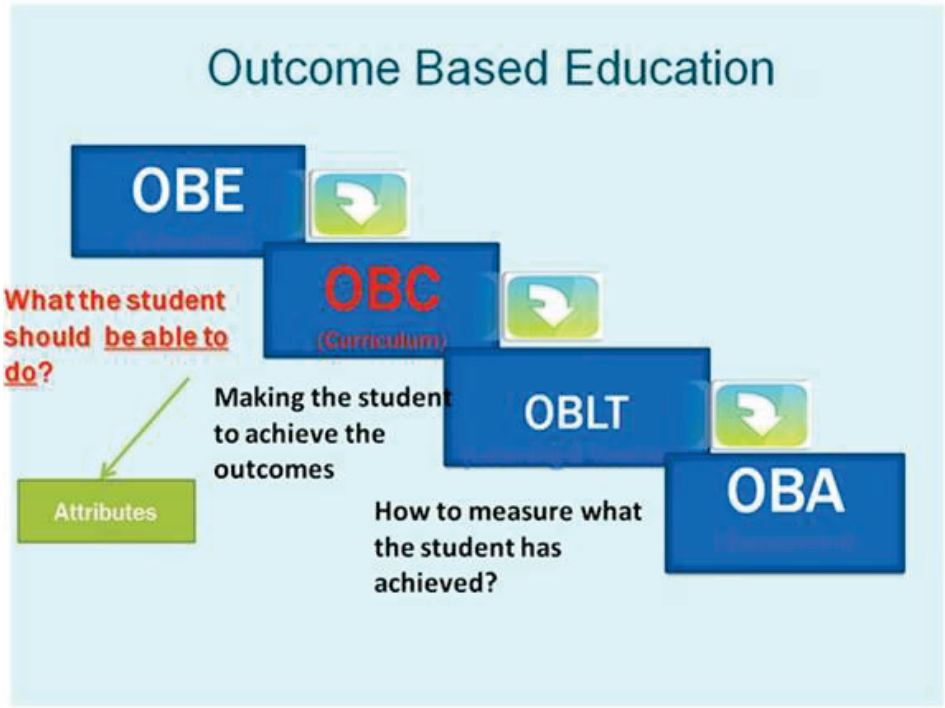

Figure 3.1. Outcome Based Education Framework

3.3.1 Outcome-Based Curriculum (OBC)

The curriculum forms the foundation of the OBE framework. An outcome-based curriculum is structured around the specific abilities and knowledge students should acquire by the end of the program. The design process begins by defining program educational objectives (PEOs), program outcomes (POs), and course outcomes (COs). These outcomes are tailored to meet the needs of stakeholders, including industries, employers, and society at large.

The key question driving an outcome-based curriculum is: **"What should students be able to do upon completing the program?"**

3.3.2 Outcome-Based Learning and Teaching (OBLT)

OBE extends beyond curriculum design to include teaching and learning practices. Outcome-based teaching and learning involve

adopting instructional strategies that actively engage students and help them achieve the desired outcomes. These methods include project-based learning, case studies, problem-solving exercises, and hands-on practical sessions.

The focus of OBLT is: **"How can we facilitate students in achieving the defined outcomes?"**

3.3.3 Outcome-Based Assessment (OBA)

Assessment plays a pivotal role in measuring whether students have achieved the intended outcomes. Outcome-based assessment uses various tools and methods, such as rubrics, assignments, projects, and exams, to evaluate student performance. These assessments are designed to provide feedback on students' mastery of skills, knowledge, and competencies.

The central question for outcome-based assessment is: **"How do we measure what students have achieved?"**

3.4 Benefits of Outcome-Based Education

The OBE approach offers several advantages that make it a preferred choice for curriculum design in engineering and technical education:

1. **Directed and Coherent Curriculum:** OBE ensures that the curriculum is well-structured and aligned with the desired outcomes, enabling a seamless progression of learning.
2. **Relevance to Industry and Stakeholders:** Graduates from OBE-aligned programs possess skills and knowledge that meet the needs of employers, industries, and society, making them more employable and impactful.
3. **Focus on Lifelong Learning:** By emphasizing critical thinking, problem-solving, and adaptability, OBE prepares students for

continuous learning and growth in their professional and personal lives.

4. **Improved Accountability:** With clear outcomes, institutions are better able to demonstrate the effectiveness of their programs to accreditation bodies and stakeholders.
5. **Enhanced Student Engagement:** The learner-centric nature of OBE encourages active participation, fostering a deeper understanding of concepts.

3.5 Key Constituents of OBE

Outcome-based education (OBE) focuses on clearly defined learning outcomes, ensuring students achieve specific knowledge, skills, and attitudes by the end of their educational experience. The following are the key constituents of OBE, which are shown in following figure:

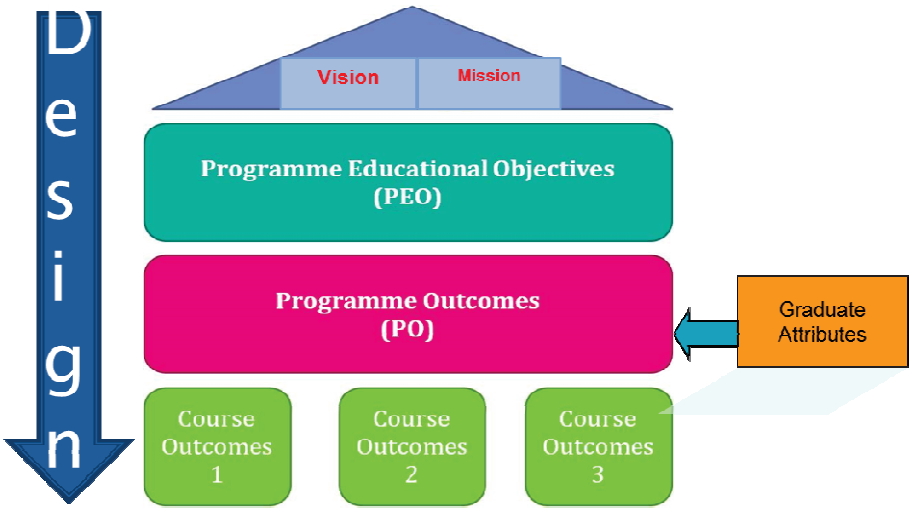

Figure 3.2. Key Constituents of OBE

1. **Vision:** Vision is a picture of the future you seek to create, described in the present tense, as if it were happening now. It

shows where we want to go, and what we will be like when we get there.

2. **Mission:** Mission statement defines what an institution is, why the institution exists, and its reason for being. It defines what we are here to do together.
3. **Graduate Attributes (GAs):** Graduate attributes are the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. WA (Washington Accord) defines 12 GA's for Engineering Graduates.
4. **Program Outcomes (POs):** Programme Outcomes (POs) describe what students should know and be able to do at the end of the programme. They are to be in line with the graduate attributes (GAs). PO's are to be specific, measurable and achievable. POs transform the PEOs into specific student performance and behaviors that demonstrate student learning and skill development.
5. **Program Specific Outcomes (PSOs):** PSOs focus on equipping students with specialized knowledge, skills, and competencies required for industry, research, or higher education, ensuring they are ready to contribute effectively in their chosen field.
6. **Program Educational Objectives (PEOs):** The Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to accomplish. PEOs should

be measurable, appropriate, realistic, time bound and achievable.

7. **Course Outcomes (COs):** Course Outcomes (COs) are specific, measurable statements that describe the knowledge, skills, and attitudes students are expected to acquire upon completing a particular course.
8. **Specific Learning Outcomes (SLOs):** Specific Learning Outcomes (SLOs) are precise, actionable statements that define the intended achievements of students for each topic or unit within a course, focusing on knowledge, skills, or attitudes.

3.6 Role of Feedback in Curriculum Design

Feedback from stakeholders plays a crucial role in designing and refining an OBE-based curriculum. Insights from industry experts ensure that the curriculum remains aligned with current trends and demands. Alumni feedback provides valuable information on the relevance of the program in real-world applications, while academic experts offer guidance on integrating innovative pedagogical practices. This collaborative approach ensures that the curriculum remains dynamic, relevant, and effective.

3.7 Conclusion

The adoption of Outcome-Based Education in curriculum design marks a significant step forward in aligning technical education with the evolving needs of the 21st century. By focusing on clearly defined outcomes and employing a structured framework, OBE ensures that students are equipped with the skills and knowledge required to thrive in their professional and personal lives. As the NBA continues to emphasize the importance of OBE for accreditation, institutions must

embrace this learner-centric approach to deliver quality education and contribute meaningfully to society.

CHAPTER 4

Bloom’s Taxonomy

Outcome-Based Education (OBE) is a learning-centered educational model where the curriculum, teaching methods, and assessments are designed to achieve specific student learning outcomes. Learning is defined as a relatively permanent change in behavior or abilities resulting from reinforced practice or experience. Educational taxonomies, such as Bloom's Taxonomy, play a crucial role in developing an OBE curriculum. Benjamin Bloom and a group of educational psychologists created this classification system to categorize learning objectives. Key aspects of Bloom's Taxonomy are foundational to designing effective learning outcomes in OBE which are outlined below.

4.1 Introduction to Bloom’s Taxonomy

In 1948, Benjamin Bloom developed a framework for classifying intellectual behavior and learning to identify and measure progressively advanced learning levels. Bloom's Taxonomy is particularly significant in higher education, where outcomes must assess students' ability to apply information rather than simply recall and repeat concepts. While lower levels of learning are easier to evaluate, they fail to fully demonstrate students' ability to utilize their knowledge. Additionally, learning extends beyond cognitive processes; it varies when it involves performing a skill or re-evaluating behavior. This approach is rooted in the biological structure of human beings, as illustrated in the figure 4.1.

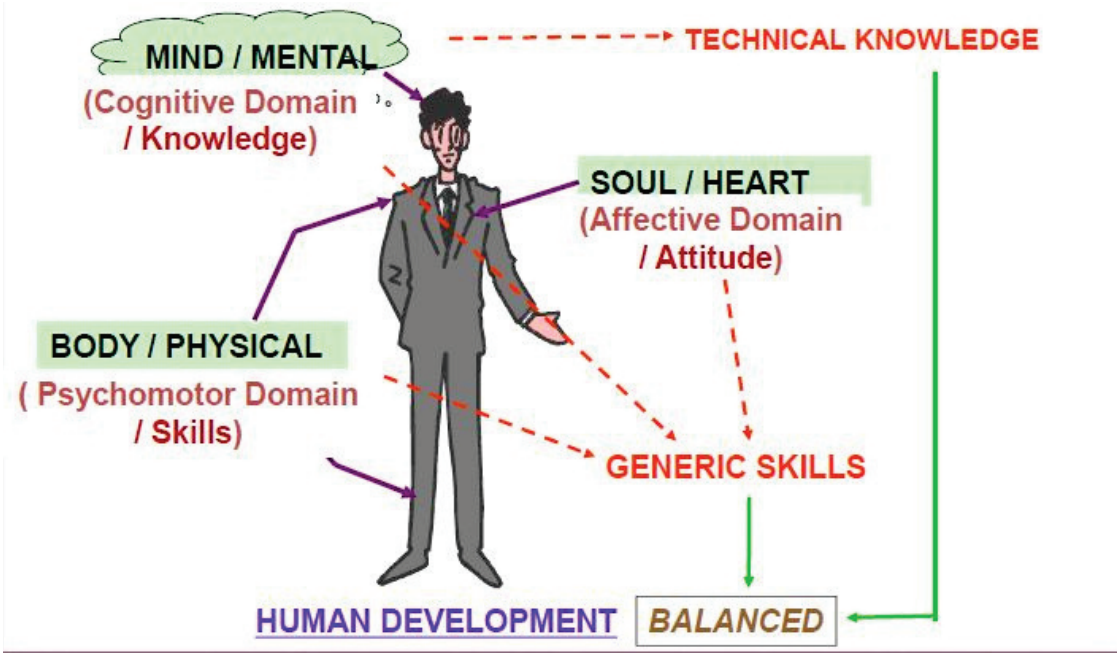

Figure 4.1. Human Being and Domains of Learning

The key elements of this approach, which form the foundation of learning, are outlined below.

4.2 Domains of Learning

Learning is the process through which students achieve a relatively permanent change in mental associations through experience, as defined by cognitive psychologists. Behavioral psychologists, on the other hand, define learning as a relatively permanent change in behavior. However, learning is not solely a cognitive function; it varies when it involves performing skills or re-evaluating behavior.

Learning encompasses the following three domains:

- **Cognitive Domain:** Focuses on intellectual skills and abilities.
- **Affective Domain:** Relates to emotions, attitudes, preferences, and values.

- **Psychomotor Domain:** Involves physical skills, such as hand-eye coordination and manipulative abilities.

In Engineering and Technology courses, the curriculum is designed to emphasize the development of cognitive skills through classroom teaching. Psychomotor skills are cultivated in workshops, laboratories, and seminars where students engage in individual or group activities. Affective skills, including attitudes and values, are nurtured through projects, co-curricular activities, and the institution's work culture.

Student progress in cognitive and psychomotor domains is evaluated through classroom learning and laboratory learning assessments respectively. Additionally, self-study learning plays a vital role by encouraging independent exploration, critical thinking, and problem-solving skills, enabling students to deepen their understanding and apply knowledge effectively.

4.2.1 Cognitive Domain

In 1956, Dr. Benjamin Bloom analyzed examination questions in the American education system and proposed a hierarchical structure of instructional objectives based on the intellectual abilities these questions assessed.

At the most basic level of cognitive learning, students demonstrate their ability to recall information directly from long-term memory. This includes retrieving facts, concepts, principles, laws, definitions, properties, and procedures. Objectives focused on memory recall were classified as knowledge-level objectives, representing the lowest tier in Bloom’s hierarchy of intellectual abilities. Questions testing memory were considered the simplest form of assessment.

The higher levels of the hierarchy introduced by Dr. Bloom in 1956, and later revised in 2001, involve progressively more complex

cognitive processes required to answer questions. These levels reflect increasing demands on the brain's ability to process and use information. The complete hierarchy, including its revised version, is depicted in the accompanying figure 4.2.

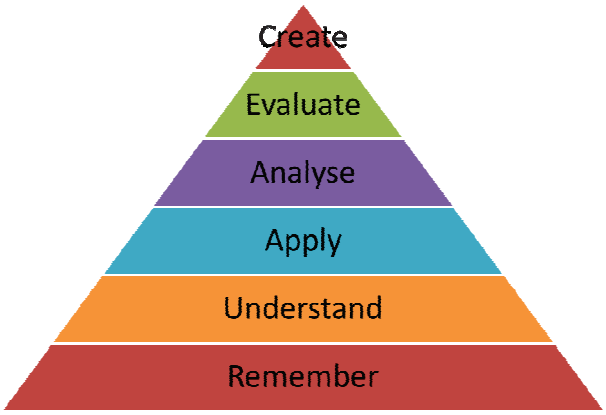

Figure 4.2. Revised cognitive hierarchy Levels

Table 4.1. Cognitive Domain Levels Action Verbs

Cognitive Domain Levels	Behavior descriptions	Action Verbs
Remember	Recall or recognize information	Define, Duplicate, List, Name, Identify, Recall, Reproduce, Recognize, Retrieve
Understand	Understand meaning, re-state data in one's own words, interpret, extrapolate, translate	Calculate, Categorize, Clarify, Classify, Compare, Conclude, Contrast, Describe, Exemplify, Expand, Illustrate, Infer, Interpret, Locate, Paraphrase, Predict, Report, Restate, Summarize, Translate

Apply	Use or apply knowledge, put theory into practice, use knowledge in response to real circumstances	Carry out, Classify, Demonstrate, Execute, Illustrate, Implement, Practice, Solve, Use, Utilize
Analyse	Interpret elements, organizational principles, structure, construction, internal relationships; quality, reliability of individual components	Appraise, Attribute, Compare, Contrast, Deconstruct, Detect, Differentiate, Discriminate, Distinguish, Examine, Formulate, Infer, Integrate, Organize, Parse, Relate, Select, Sequence, Structure, Test
Evaluate	Assess effectiveness of whole concepts, in relation to values, outputs, efficacy, viability; critical thinking, strategic comparison and review; judgment relating to external criteria	Appraise, Check, Coordinate, Critique, Defend, Detect, Dispute, Judge, Monitor, Prioritize, Rate, Reconstruct, Select, Support, Verify
Create	Develop new unique structures, systems, models, approaches, ideas; creative thinking, operations	Change, Combine, Compile, Compose, Construct, Create, Design, Formulate, Generate, Hypothesize, Improve, Invent, Plan, Predict, Produce

4.2.1 Psychomotor Domain

The Psychomotor Domain, as defined by R.H. Dave in 1970, was introduced to focus on the development of skills related to the physical aspects of performing tasks. Since 'motor' skills go beyond the traditional notion of manual and physical abilities, it is important to incorporate this domain, even if the Cognitive and Affective Domains appear sufficient in your context. Regardless of the scenario, the Psychomotor Domain is likely to play a significant role.

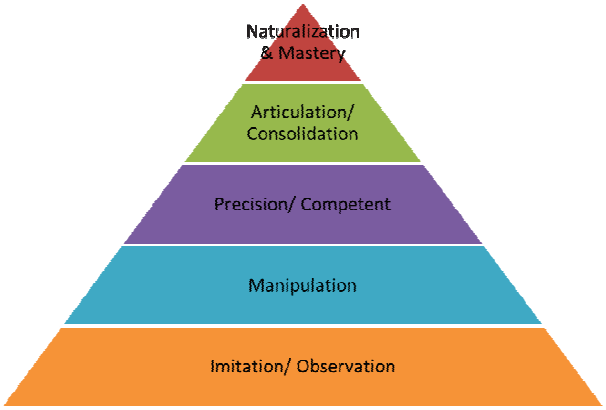

Figure 4.3. Psychomotor hierarchy Levels

Table 4.2. Psychomotor Domain Levels Action Verbs

Psychomotor Domain Levels	Behavior descriptions	Action Verbs
Imitation/ observation	Copy action of another; observe and replicate	Copy, follow, replicate, repeat, adhere, attempt, reproduce, organize, sketch, duplicate
Manipulation	Reproduce activity from instruction or memory	Re-create, build, perform, execute, implement, acquire, conduct, operate
Precision/ competent	Execute skill reliably, independent of help, activity is quick, smooth, and accurate	Demonstrate, complete, show, perfect, calibrate, control, achieve, accomplish, master, refine
Articulation/ consolidation	Adapt and integrate expertise to satisfy a new context or task	Solve, adapt, combine, coordinate, revise, integrate, adapt, develop, formulate, modify, master
Naturalization & Mastery	Instinctive, effortless, unconscious mastery of activity and related skills at strategic level	Construct, compose, create, design, specify, manage, invent, project-manage, originate

4.2.1 Affective Domain

The Affective Domain, as outlined by Bloom, Krathwohl, and Masia in *Taxonomy of Educational Objectives: Vol. II* (1964)*, The Affective Domain*, emphasizes the development of attitudes, which are now often referred to as 'beliefs' in personal development. Bloom's theory proposes a structure and sequence for cultivating attitudes, providing a framework for teaching, training, and evaluating the effectiveness of instruction. This framework also helps assess the impact on learners, including how well the training is retained and its influence on the individual.

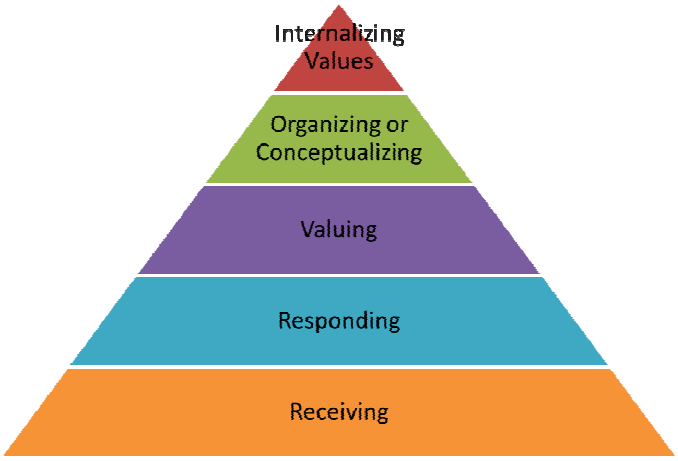

Figure 4.4. Affective Domain hierarchy Levels

Table 4.3. Affective Domain Levels Action Verbs

Affective Domain Levels	Behavior descriptions	Action Verbs
Receiving	Open to experience, willing to hear	Ask, listen, focus, attend, take part, acknowledge, hear, be open to, retain, follow, concentrate, read, do, feel
Responding	React and participate actively	React, respond, interpret, clarify, contribute, question, present, cite, write, perform

Valuing	Attach values and express personal opinions	Argue, challenge, debate, refute, confront, justify, persuade, criticize,
Organizing or Conceptualizing	Reconcile internal conflicts; develop value system	Build, develop, formulate, defend, modify, relate, prioritize, reconcile, contrast, arrange, compare
Internalizing Values	Adopt belief system and philosophy	Act, display, influence, solve, practice,

4.3 Program Outcomes and Domains of Learning

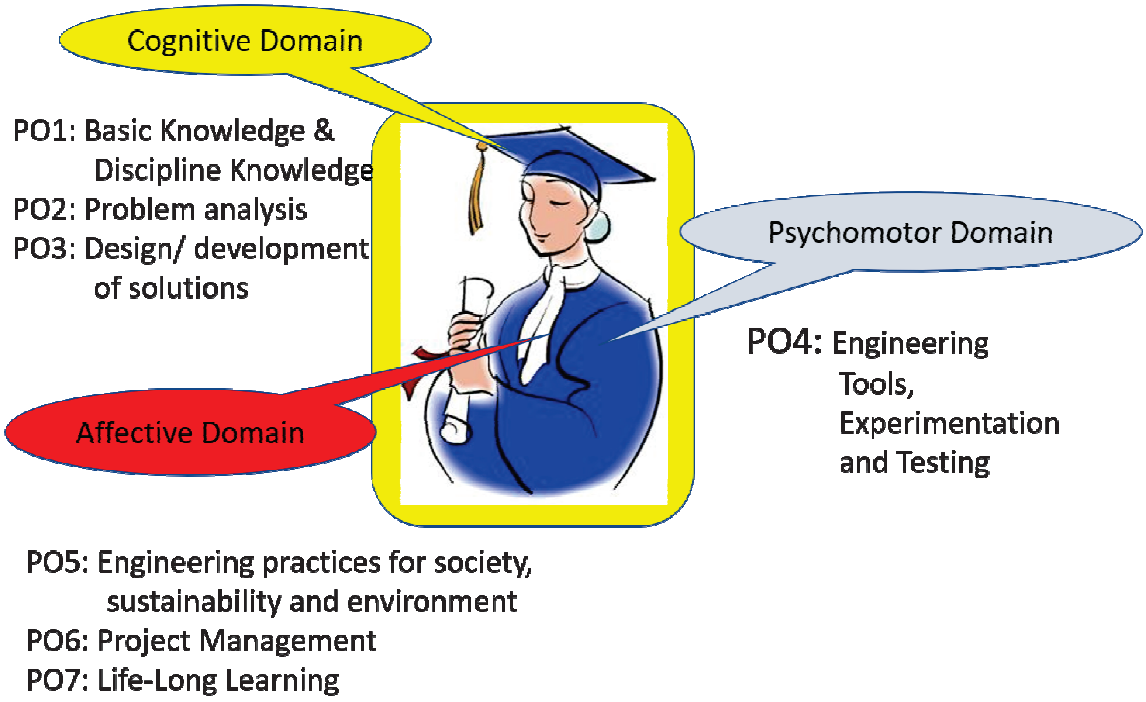

Figure 4.5. Program Outcomes and Domains of Learning

Program Outcomes (POs) defined by the NBA for diploma students represent the specific skills and characteristics expected by stakeholders from the students. These outcomes are closely linked to the three domains of learning, as illustrated in the figure. This classification plays a key role in shaping the curriculum.

4.4 Conclusion

Outcome-Based Education (OBE) provides a structured framework for aligning curriculum, teaching methodologies, and assessments with clearly defined learning outcomes. Rooted in the OBE philosophy, this approach ensures that the curriculum of GPN is designed to develop competencies that meet academic and professional expectations. By leveraging educational taxonomies, educators can systematically define and assess learning objectives across cognitive, affective, and psychomotor domains. A well-implemented OBE model enhances student learning by focusing on measurable outcomes and continuous improvement.

CHAPTER 5

SWOT Analysis for OBE Curriculum Development

SWOT analysis, a strategic planning tool, plays a vital role in developing an effective Outcome-Based Education (OBE) curriculum. By systematically identifying Strengths, Weaknesses, Opportunities, and Threats (SWOT), institutions can align their educational programs with stakeholders' needs and expectations. This chapter outlines a stepwise approach for conducting a SWOT analysis as part of the curriculum development process.

5.1 Stepwise Procedure for SWOT Analysis

The stepwise procedure for SWOT analysis involves preparing a questionnaire, gathering feedback via digital forms, and analyzing responses at the department level. This systematic approach concludes with actionable insights to refine the curriculum and align it with stakeholder needs.

5.1.1 Identify the Questionnaire for Conducting SWOT Analysis

The first step involves formulating a questionnaire that will serve as a foundation for gathering feedback. The Curriculum Development Cell (CDC) collaborates with stakeholders to create questions targeting key areas such as academic quality, infrastructure, teaching methodologies, industry relevance, and overall program effectiveness. These questions must be:

- Clear and concise.
- Relevant to the program’s objectives and outcomes.
- Designed to elicit actionable insights.

Example Questions:

- What are the program's key strengths that contribute to achieving its objectives?
- What challenges or weaknesses hinder program effectiveness?
- What opportunities can be leveraged to enhance the curriculum?
- What external threats could impact the program’s success?

5.1.2 Finalize the Questionnaire through Program-Level Brainstorming

The draft questionnaire is reviewed and refined through brainstorming sessions at the program level. Faculty members, department heads, and other relevant stakeholders participate in this collaborative process to ensure:

- Comprehensive coverage of all critical aspects.
- Inclusion of diverse perspectives.
- Alignment with the program’s vision and mission.

The finalized questionnaire should be validated for clarity and relevance before proceeding to the next step.

5.1.3 Prepare Google Forms for Feedback Collection

Each program uses the finalized questionnaire to create digital feedback forms, such as Google Forms, to ensure ease of access and convenience for respondents. The forms are designed to:

- Include multiple-choice, Likert scale, and open-ended questions.
- Ensure anonymity to encourage honest feedback.
- Be mobile-friendly to maximize response rates.

Feedback is solicited from key stakeholders:

- **Faculty**: Insights on academic and administrative challenges.
- **Students**: Perspectives on learning experiences and outcomes.
- **Alumni**: Reflections on the program’s impact in their professional lives.

5.1.4 Conduct Feedback Analysis at the Department Level

The collected data is analyzed at the departmental level to derive meaningful insights. The analysis process includes:

- **Quantitative Analysis**: Statistical methods to summarize responses and identify trends.
- **Qualitative Analysis**: Thematic analysis of open-ended responses to uncover nuanced insights.

Departments categorize the findings under the four SWOT components:

- **Strengths**: Areas of excellence and key program differentiators.
- **Weaknesses**: Areas needing improvement.
- **Opportunities**: Emerging trends and potential areas for growth.
- **Threats**: External factors that may pose challenges.

5.1.5 Conclude the SWOT Analysis

The final step is to summarize and document the findings of the SWOT analysis. This involves:

- Preparing a comprehensive report highlighting key observations and actionable recommendations.
- Sharing the report with stakeholders, including the CDC and institutional leadership.
- Using the findings to inform curriculum revisions, resource allocation, and strategic planning.

Example Outcome:

- Strength: Strong industry tie-ups for internships and placements.
- Weakness: Limited access to advanced laboratory equipment.
- Opportunity: Growing demand for skill-based courses in emerging technologies.

- Threat: Increasing competition from online education platforms.

5.2 SWOT analysis of Civil Engineering Program

5.2.1 Strengths (S):

1. Highly Experienced Faculty (83.3%): The department's experienced faculty is a significant strength, contributing to its academic excellence.
2. Modern Curriculum (65.2%): The alignment of the curriculum with industry needs is a notable advantage.
3. Excellent Hands-On Training (47.6%): The department's ability to provide practical training is highly appreciated.
4. Faculty Reputation (86.3%): Faculty plays a major role in enhancing the department's reputation.
5. Inclusive Learning Environment (56.6%): Inclusive and supportive faculty enhance the learning environment.

5.2.2 Weaknesses (W):

6. Laboratory Upgradation (40.6%): Immediate improvements are needed in laboratory facilities.
7. Student Engagement (40.6%): Student clubs and organizations require more engagement.
8. Non-Traditional Student Support (7.6%): Strategies for supporting non-traditional students need enhancement.
9. Interdisciplinary Initiatives (8.6%): More efforts are needed to engage in interdisciplinary projects.
10. Diversity in Course Offerings (15.3%): Curriculum relevance needs improvement.

5.2.3 Opportunities (O):

1. Emerging Technologies (60.3%): Opportunities lie in areas like electric vehicles and smart grids.
2. Community Engagement (76.6%): Opportunities exist to contribute to community development.
3. Sustainable Technologies (93.3%): The department can make significant contributions to sustainable technologies.
4. Industry Collaborations (60.6%): Effective engagement with local industries for collaborative projects.
5. Value-Added Courses (24.3%): Opportunities to improve value-added courses in the curriculum..

5.2.4 Threats (T):

1. Government Budget Cuts (40.9%): Potential reductions in funding pose a threat.
2. Rapid Technological Disruptions (15.6%): Adapting to technological changes is challenging.
3. Funding Uncertainty (71.6%): Uncertainty in funding sources is a significant concern.
4. Limited Elective Courses (6%): Providing a variety of elective courses is essential.
5. Inadequate Interdisciplinary Initiatives (6.9%): Expanding interdisciplinary projects is critical.

5.3 Conclusion

SWOT analysis is a critical step in the OBE curriculum development process, enabling institutions to align their programs with stakeholder needs and industry trends. By following the stepwise procedure outlined in this chapter, programs can ensure a systematic, inclusive,

and data-driven approach to curriculum improvement, fostering academic excellence and long-term success.

CHAPTER 6

Curriculum Revision Process

Since attaining autonomous status, GPN has revised its curriculum every five years, with the 2023 revision marking the seventh iteration. While the concept of Bloom's Taxonomy has been part of the GPN curriculum from the start, the comprehensive Outcome-Based Education (OBE) model was first implemented in the 2016 curriculum and has been carried forward to the 2023 curriculum. The 2023 curriculum is also aligned with the National Education Policy 2020. The detailed process of revising the 2023 curriculum is outlined below.

6.1 Change Management

GPN, a diploma-level educational institute, offers 14 diploma programs, 13 of which operate under autonomous status. Revising the curriculum for these programs within a short timeframe, while adopting a new and unfamiliar model, posed a significant challenge for the Curriculum Development Committee (CDC). It is natural for individuals to resist change, even under the best circumstances.

To address this, GPN implemented the ADKAR model for change management. This diagnostic tool enabled the institution and its staff to understand their position in the change process. It also helped identify gaps in the change management process and provided effective coaching for faculty members.

The ADKAR model was instrumental in:

- Managing faculty resistance.
- Guiding faculty through the transition process.

- Creating a successful action plan for curriculum development.
- Developing an effective strategy for curriculum design and implementation.

6.1.1 ADKAR Model for Change Management

The ADKAR model has gained significant popularity among managers and project teams due to its simplicity and ease of application. It is also effective in educating others, including executive sponsors of change. ADKAR represents five key building blocks for successful change:

- **Awareness**: Understanding the need for change.
- **Desire**: Willingness to participate in and support the change.
- **Knowledge**: Learning how to implement the change.
- **Ability**: Developing the skills and behaviors required for the change.
- **Reinforcement**: Ensuring the change is sustained over time.

In the curriculum revision process, the following change management tools are utilized:

1. Communication
2. Motivation
3. Workshops
4. Resistance Management
5. Training

Figure 6.1 illustrates the mapping of these tools with the ADKAR framework.

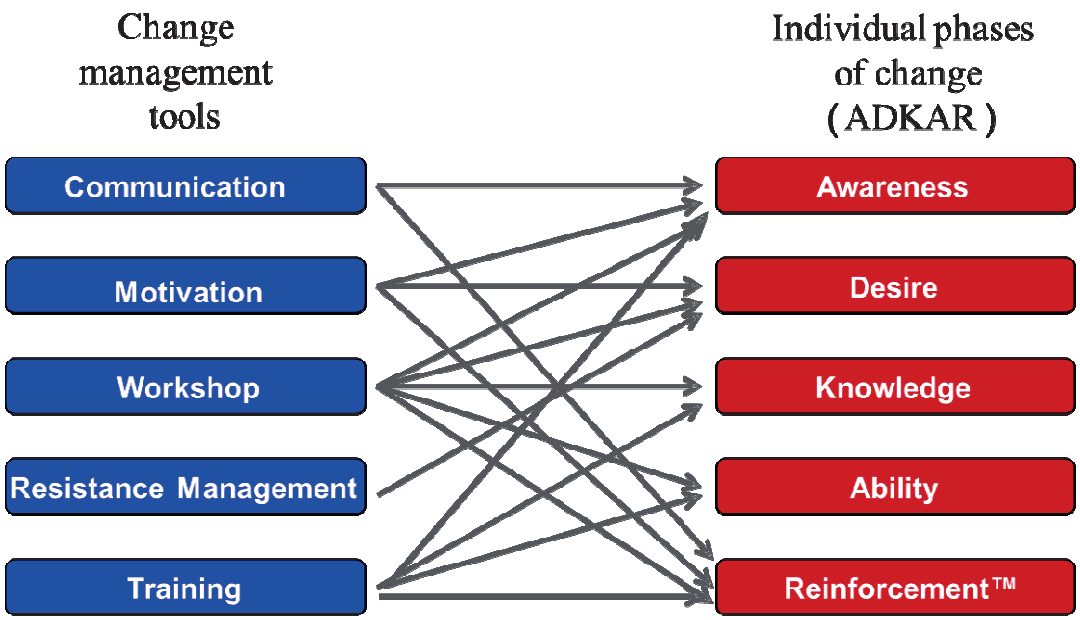

Figure 6.1. Mapping of change management tools with ADKAR

6.1.2 Results of ADKAR Model

The application of the ADKAR model in the curriculum revision process achieved the following results:

- Start Date of Curriculum Revision Process: **16/08/2023**
- Completion Date of Curriculum Revision Process: **31/12/2024**
- Duration to Complete Curriculum Revision: **16 ½ months**
- Number of Programs: **13**
- Number of Course curriculum Developed: **383**
- Implementation of NEP aligned OBE curriculum from for First Semester: **September 2023**

6.2 Curriculum Development Process

Curriculum development is a systematic process aimed at designing and refining educational programs to meet the needs of learners and

stakeholders. The steps outlined below describe an effective approach for developing a curriculum based on identified competencies and skills

6.2.1 Identify the Competencies and Skills

The first step in curriculum development involves identifying the key competencies and skills that students must acquire. This stage requires a thorough understanding of industry demands, technological advancements, and stakeholder expectations. Input from subject matter experts, educators, and industry professionals is crucial to ensure the relevance of the competencies and skills being identified.

Key Activities:

- Conduct surveys through internet.
- Review current trends and advancements in the field.
- Analyze job descriptions and roles to pinpoint essential skills.

Outcome: A comprehensive list of competencies and skills required by learners to succeed in their field. List of competencies and skills for various diploma programs prepared by Curriculum Development Cell is shown in Figure 6.2 (Screen Shot).

S.N.	Diploma in Electrical Engineering Students will be able to:
1	Apply principles of physics to solve broad based relevant engineering problems.
2	Apply principles of chemistry to solve broad based relevant engineering problems.
3	Use computers for documentation, presentation, analyse data and Internet services.
4	Prepare engineering drawing using prevailing drawing instruments.
5	Apply the concept of Mathematics to solve industry-based technology problems.
6	Use different engineering tools for performing shop floor activities.
7	Use basic principles in electrical engineering for different applications
8	Use electronic components and circuits for electrical applications.
9	Apply principles of mechanical engineering to solve broad based engineering problems
10	Analyze electrical circuits to determine voltage, current, and power relationships.
11	Conduct electrical tests and measurements accurately and interpret the results.
12	Operate and maintain various electrical machines, ensuring optimal performance.
13	Operate and maintain transformers for electrical systems.
14	Operate and maintain generators for power generation.
15	Apply the principles of power distribution systems and effectively manage electrical distribution.
16	Apply the principles of power transmission systems and effectively manage electrical transmissio
17	Proficient in using electrical instrumentation for data collection and analysis.

Civil | Mechanical | Electrical | Electronics | Packaging | Automobile | Metallurgy | Computer

Figure 6.2. Identification of Competencies and Skills

6.2.2 Finalize Competencies and Skills

Once the competencies and skills have been identified, they are refined and finalized to ensure alignment with the program's objectives. This involves collaboration with key stakeholders to validate the findings and incorporate their feedback.

Key Activities:

- Organize meetings with curriculum development cell.
- Prioritize competencies and skills based on their importance and applicability.
- Document finalized competencies and skills for further use.

Outcome: A finalized and well-documented list of competencies and skills, forming the foundation of the curriculum.

Score	Hands on Skills
3.7	Conduct electrical tests using instruments such as multimeters, and other testing equipment to evaluate the performance of electrical system.
3.5	Wire and install electrical components, switches, outlets, and lighting fixtures.
3.5	Diagnose and troubleshoot electrical faults and problems in electrical equipment and domestic appliances.
3.4	Assemble and solder electronic components onto circuit boards.
3	Repair and modify electronic devices and PCBs.
3.3	Calibrate and maintain electrical instrumentation devices for measurement and control.
3.2	Install and maintain solar panels, wind turbines, and other renewable energy systems.
3	Install and maintain EV charging stations and systems.
3.3	Create and interpret electrical schematics and drawings using CAD software.
3.4	Conduct safety audits and inspections to ensure compliance with electrical safety standards.
3.2	Build and wire electrical panels and control cabinets.
2.8	Develop digital control systems for motors, power converters and battery stems using MATLAB and Simulink

Figure 6.3. Finalized List of Competencies and Skills

6.2.3 Obtain Feedback Through Google Forms

To ensure the relevance and quality of the identified competencies and skills, feedback is gathered from a broader audience. Google Forms is an effective tool for collecting responses from various stakeholders, including faculty members, industry representatives, and alumni.

Key Activities:

- Design a structured feedback form.
- Share the Google Form with relevant stakeholders through email and social media.
- Encourage stakeholders to provide honest and constructive feedback.

Outcome: A diverse set of feedback data that highlights the strengths and areas for improvement in the proposed competencies and skills.

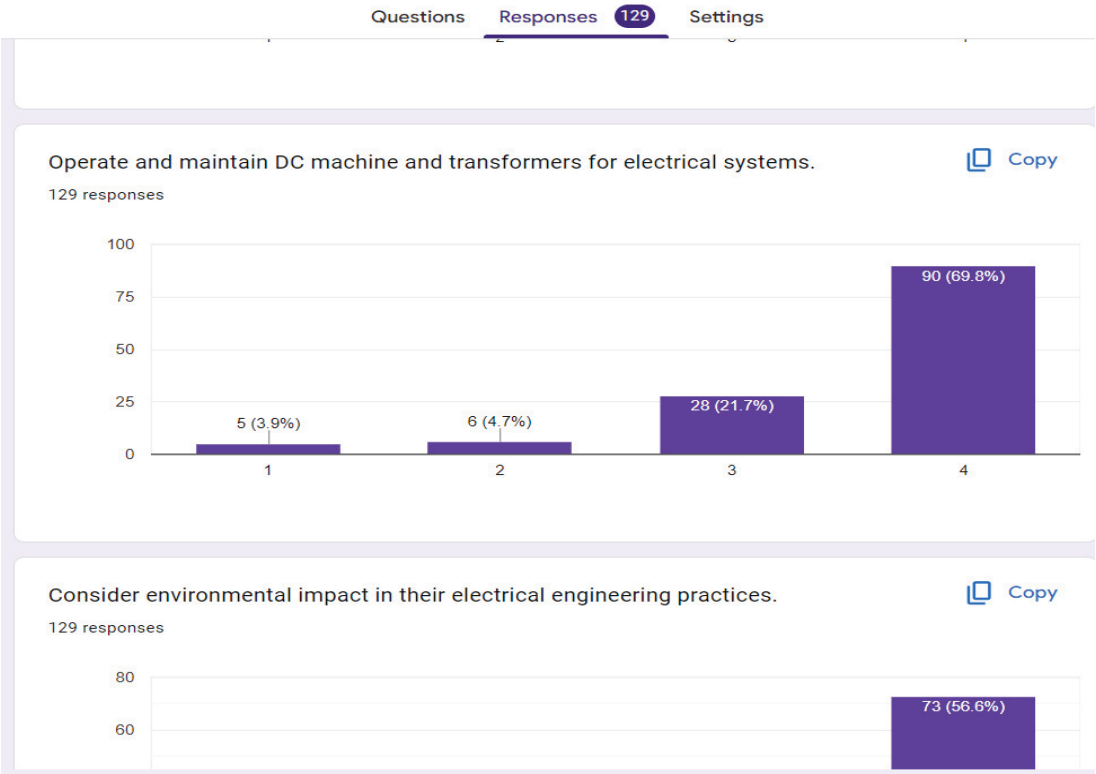

Figure 6.4. Feedback through Google Form

6.2.4 Perform Feedback Analysis

The feedback collected is analyzed to identify patterns, trends, and actionable insights. This step ensures that the curriculum aligns with stakeholder expectations and meets industry requirements.

Key Activities:

- Categorize feedback based on common themes and suggestions.
- Use data analysis tools to interpret quantitative and qualitative responses.
- Summarize findings and identify key takeaways.

Outcome: A clear understanding of stakeholder perspectives, which informs the validation process.

	A	B	C	D	E	F	G
1	Competencies	ME	E	D	NR	Total	Score
2	Communicate technical information clearly and effectively.	105	16	4	4	105	3.72093
3	Create and interpret electrical drawings and diagrams accurately.	95	26	3	5	95	3.635659
4	Prioritize safety in electrical engineering practices and adhere to established safety protocols.	97	21	7	4	97	3.635659
5	Identify, select, and use appropriate electrical materials and components.	90	30	6	3	90	3.604651
6	Use computers for documentation, presentation, analyze data and Internet services.	93	24	7	5	93	3.589147
7	Operate and maintain DC machine and transformers for electrical systems.	90	28	6	5	90	3.573643
8	Maintain electrical switchgears and protection systems to safeguard equipment and personnel.	88	29	9	3	88	3.565891
9	Optimize energy usage and promote energy efficiency in electrical systems.	87	30	8	4	87	3.550388
10	Use basic principles in electrical engineering for different applications.	89	25	12	3	89	3.550388
11	Exhibit leadership qualities and Manage time efficiently to meet project deadlines and goals.	84	35	6	4	84	3.542636
12	Implement renewable energy systems.	84	34	8	3	84	3.542636
13	Demonstrate a commitment to lifelong learning and professional development.	85	29	12	3	85	3.51938
14	Use electronic components and circuits for electrical applications.	86	30	6	7	86	3.511628
15	Use electrical instrumentation for data collection and analysis.	83	32	11	3	83	3.511628

Form Responses 1 | Analysis | Sheet2 | +

Figure 6.5. Feedback Analysis

6.2.5 Validate Competencies and Skills in Search Conference

The search conference is a structured event aimed at fostering dialogue among key stakeholders in education and industry. It serves as a forum for validating existing skills, identifying new competencies, and refining curriculum frameworks to ensure that graduates are equipped to meet industry demands. By involving a diverse array of participants, including industry professionals, academic experts, and alumni, the search conference creates a comprehensive feedback loop essential for continuous improvement in education.

The search conference is organized after systematically gathering feedback from stakeholders, ensuring that their insights and suggestions form the foundation of discussions and decisions. This preparatory step ensures that the conference discussions are relevant, targeted, and actionable, paving the way for meaningful outcomes.

During the Search Conference, additional suggestions are gathered from participants to further refine the curriculum. This step ensures inclusivity and leverages the expertise of diverse participants.

Objectives of the Search Conference

The primary objectives of organizing a search conference are as follows:

1. **Validation of Skills**: The search conference provides an opportunity to validate the competencies and skills outlined by the academic program. Industry experts assess whether these competencies and skills align with current workplace requirements, ensuring graduates possess competencies relevant to their fields.

2. **Identification of New Skills**: With rapid technological advancements and changing job roles, new skill sets are continually emerging. Industry and field experts suggest additional competencies that technicians need to excel in their specific work areas.
3. **Feedback Collection**: Feedback on the existing curriculum is gathered to identify strengths and areas for improvement. This includes reviewing suggestions from prior conferences or feedback sessions, creating a continuous cycle of curriculum enhancement.
4. **Curriculum Enhancement**: The conference serves as a brainstorming platform to propose new course content that reflects industry trends and innovations. This ensures the curriculum remains dynamic and forward-looking.
5. **Program Structure Analysis**: Stakeholders provide insights and suggestions on broader aspects of the program structure, such as course sequencing, interdisciplinary integration, and practical training components.
6. **Skills Analysis and Course Formation**: The validated and newly identified competencies and skills are analyzed to prepare a final list. This serves as a foundation for designing or revising courses that align with these skills, ensuring a targeted and effective educational approach.

Key Activities:

- Organize the Search Conference with representatives from academia, industry, and alumni.
- Present the identified competencies and skills for discussion.

- Facilitate group discussions to ensure active participation and consensus-building.

Outcome: The courses are designed based on competencies and skills validated during the Search Conference, ensuring alignment with industry needs. Inputs from the conference were systematically incorporated to create an industry-relevant, practical, and dynamic curriculum.

Industry Survey Rating Report for Diploma in Electrical Engineering

Competencies Required for Diploma in Electrical Engineering

S.N.	Competencies (What diploma holders will be able to do in the industry at entry level) Legends: ME-Most Essential, E-Essential, D-Desirable, NR-Not Required	ME	E	D	NR	Total	Score	Rank
1	Communicate technical information clearly and effectively.	105	16	4	4	129	3.72093	1
2	Create and interpret electrical drawings and diagrams accurately.	95	26	3	5	129	3.635659	2
3	Prioritize safety in electrical engineering practices and adhere to established safety protocols.	97	21	7	4	129	3.635659	3
4	Identify, select, and use appropriate	90	30	6	3	129	3.604651	4

ty: Investigate

Figure 6.6. Industry Survey Rating Report

Diploma in Electrical Engineering

Formation of Courses according to Industry Feedback

S.N.	Competencies (What diploma holders will be able to do in the industry at entry level)	Rank based on Industry Feedback	Name of Course to be introduced in Curriculum	Remarks (if any)	Course Category DSC/DSE/SEC/AEC/VEC/INP etc.	Semester of the course
1	Communicate technical information clearly and effectively.	1	Communication Skill		AEC	First
2	Create and interpret electrical drawings and diagrams accurately.	2	Electrical Software and Computer Aided Drawing		SEC	
3	Prioritize safety in electrical engineering practices and adhere to established safety protocols.	3	Testing and Maintenance of Electrical Machines		DSC	Sixth
4	Identify, select, and use appropriate electrical materials and components.	4	Electrical Wiring		SEC	Third

Figure 6.7. Identified Courses List based on Industry Survey

6.2.6 Preparation of Program Structure

After analyzing the NEP 2020 guidelines, Government of Maharashtra GRs for NEP implementation, and conducting brainstorming sessions, the program structure is designed to align with NEP 2020 policies and industry standards. This step ensures a balanced curriculum that fosters holistic development and interdisciplinary learning.

Key Activities:

- Map courses to the seven verticals defined in NEP 2020 guidelines.
- Identify core, elective, skill-enhancement, value education, and internship courses for comprehensive coverage.
- Define semester-wise and course-wise credit distribution.
- Ensure interdisciplinary and multidisciplinary integration as per NEP requirements.

Outcome:

A well-structured program framework that reflects NEP 2020 principles, integrates stakeholder inputs, and supports the achievement of desired learning outcomes.

Table 6.1 presents the basic program structure common to all diploma programs in engineering. Figure 6.5 provides a visual representation of the program structure, including the exit options for a Certificate in Vocation after the first year and a Diploma in Vocation after the second year.

Table 6.1. Basic Program Structure

SN	Semester	DSC	DSE	GE	AEC	SEC	VEC	INP	Total Courses (Credits)
1	Sem I	DSC 1 (4) DSC 2 (4) DSC 3 (3)			AEC 1 (3)	SEC 1 (2) SEC 2 (2)	VEC 1 (2)		7 (20)
2	Sem II	DSC 4 (4) DSC 5 (4) DSC 6 (3) DSC 7 (3)			AEC 2 (2)	SEC3 (2)	VEC 2 (2)		7 (20)
3	Sem III	DSC 8 (3) DSC 9 (3) DSC10(3) DSC11(3)		GE 1 (2)		SEC 4 (2)	VEC 3 (2)	INP (4)	8 (22)
4	Sem IV	DSC12(3) DSC13(5) DSC14(4)	DSE 1 (3)	GE 2 (2)		SEC 5 (3)	VEC 4 (2)		7 (22)
5	Sem V	DSC15(3) DSC16(4)	DSE 2 (3)	GE 3 (2)		SEC 6 (2)	VEC 5 (1)	INP 1 (1) INP 2 (6)	8 (22)
6	Sem VI	DSC17(3) DSC18(3) DSC19(3)	DSE 3 (3)			SEC 7 (2)	VEC 6 (1)	INP 3 (1) INP 4 (6)	8 (22)
	Total Courses (Credits) Percentage Credits	19 (65) 50.78%	3 (9) 7.03%	3 (6) 4.68%	2 (5) 3.90%	7 (15) 11.71%	6 (10) 7.81%	5 (18) 14.06%	45 (128)

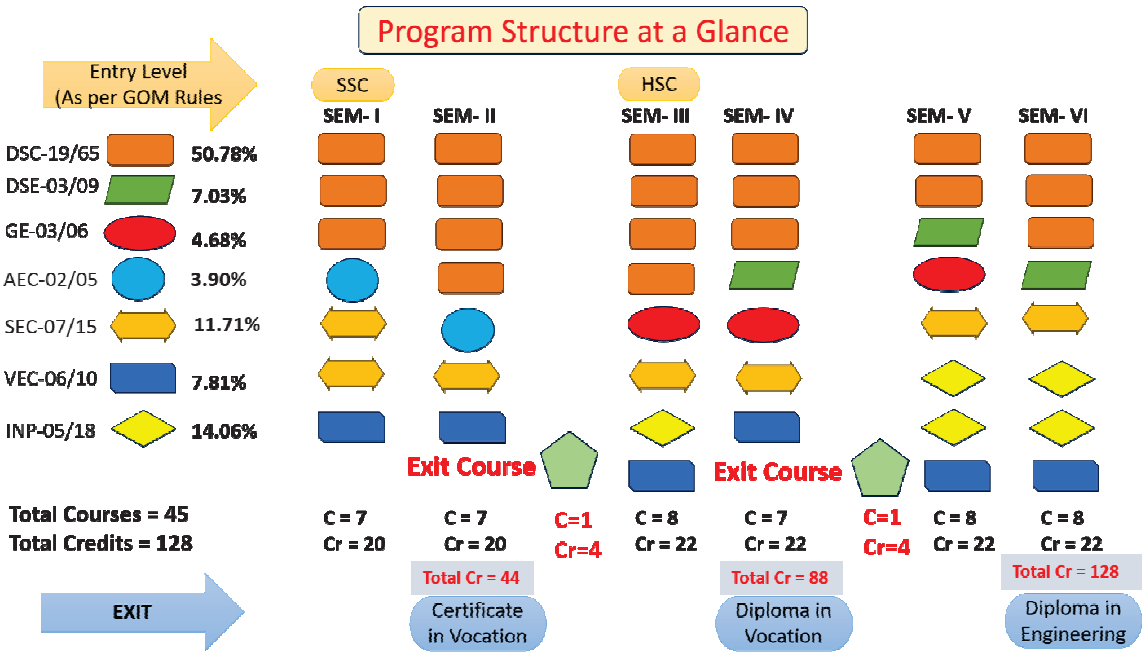

Figure 6.8. Basic Program Structure

6.2.7 Preparation of Course Curriculum

The course curriculum is developed based on industry-identified competencies, ensuring alignment with real-world demands and enhancing employability. Faculty members play a key role in integrating these competencies into the course design, focusing on practical and theoretical balance.

Key Activities:

- Align identified competencies with course outcomes (COs) and specific learning outcomes (SLOs).
- Develop course content that integrates classroom learning, laboratory learning, and self-study learning.
- Design assessment strategies to effectively measure the attainment of industry identified competencies.
- Identify essential textbooks, e-references, and major equipment required for course delivery.
- Establish a mapping framework to correlate course outcomes (COs) with program outcomes (POs) and program-specific outcomes (PSOs).

Outcome:

A NEP 2020 aligned competency-based OBE course curriculum that addresses industry requirements, promotes skill development, and ensures students are job-ready upon completion of diploma program.

6.2.8 Approval from AB, PBOS, BOS and GB

The program structure for all programs and the course curricula are approved by their respective PBOS, while the curricula for Science, Mathematics, and Humanities departments are approved by the Academic Board (AB). Science, Mathematics, and Humanities courses are also presented to the PBOS of each program for review and

approval. Suggestions received during PBOS meetings are incorporated before submission to the Board of Studies (BOS). All approved curricula are then forwarded to the Governing Body (GB) for final approval, incorporating the suggestions obtained from BOS.

6.3 Curriculum Development at a Glance

- No. of Programs : 13
- No. of Courses : 383
- No. of GB Meetings : 04
- No. of BOS Meetings : 04
- No. of PBOS Meetings : 52
- No. of AB Meetings : 04
- No. of ILC Meetings : 02
- No. of Coordinators Meetings : 09
- Trainings Workshops : 04
- Search Conference : 01
- No. of Industry Experts in Search Conference : 39
- No. of Faculties Involved : 101
- No. of outside Experts Involved : 39
- Curriculum Editing Workshops : 52
- Industries Feedback (for each Program) :100+

6.4 Conclusion

The detailed process of revising the 2023 curriculum has been comprehensively outlined in this chapter, covering the key methodologies, considerations, and steps involved in the revision. This structured approach ensures alignment with industry requirements, technological advancements, and educational best practices. While this

chapter focuses on the process of curriculum revision, the subsequent chapter delves into the distinctive features of the revised curriculum, highlighting its key components.

CHAPTER 7

Features of NEP Aligned Curriculum

The National Education Policy (NEP) 2020 marks a transformative shift in the Indian education system, emphasizing holistic, multidisciplinary, and flexible learning. Its curriculum framework is designed to foster critical thinking, creativity, and global competencies while rooted in India's cultural ethos. Below are the key features of an NEP 2020-aligned curriculum of GPN.

7.1 Introduction

The National Education Policy (NEP) 2020 has introduced significant reforms in India's education system, emphasizing a holistic, flexible, multidisciplinary, and skill-based approach to learning. To align with these objectives, the Government of Maharashtra issued guidelines for implementing NEP 2020 in undergraduate (UG) engineering courses. The Board of Studies (BOS) deliberated on these developments, highlighting the need to align diploma-level curricula with NEP principles.

Although specific guidelines for diploma institutions were initially unavailable, the BOS decided to implement the NEP-aligned curriculum from the 2024 academic session. Consequently, the Curriculum Development Cell (CDC) was tasked with formulating an action plan for program structure and first-semester curriculum development by December 2023. Meanwhile, the Maharashtra State Board of Technical Education (MSBTE) had already initiated curriculum restructuring four months earlier and announced the implementation of an NEP-aligned curriculum for diploma institutions. Subsequently, MSBTE mandated

that all autonomous diploma institutions adopt the NEP-aligned curriculum from the 2023-24 academic year.

In light of these developments, the restructuring of the 2021 curriculum to comply with NEP 2020 guidelines has become essential. A final decision has been made to implement the NEP-aligned curriculum from the 2023-24 academic year.

7.2 Initiatives by the CDC Cell

Before MSBTE's Decision

1. **Institute-Level Committee Meeting**: Conducted on 24th July 2023 to plan curriculum alignment with NEP 2020.
2. **NEP 2020 Workshop**: Organized on 7th and 8th August 2023 for Heads of Departments (HODs) and faculty members.
3. **Formation of Program-Wise Board of Studies (PBOS)**: PBOS committees were constituted to oversee curriculum development.

After MSBTE's Decision

1. **Development of Tentative Program Structure and Curriculum Format**: Drafted between 15th and 16th August 2023, adhering to NEP, UG, and MSBTE guidelines.
2. **Institute-Level Committee Meetings**: Conducted on 17th and 29th August 2023 to review progress.
3. **Curriculum Development Workshop**: Held on 19th August 2023 for curriculum drafting and refinement.
4. **PBOS Meetings**: Held between 22nd to 29th August 2023 for detailed discussions on program structure.

7.3 Features of NEP aligned curriculum

The features of NEP aligned curriculum of GPN are mentioned below.

7.3.1 Seven Verticals

The Curriculum Development Cell (CDC) conducted a comparative analysis of the verticals and found that all verticals proposed for the undergraduate (UG) program by the Government of Maharashtra (GoM) are already included in the Maharashtra State Board of Technical Education (MSBTE) framework, with only differences in nomenclature. The detailed nomenclature of UG program proposed by GOM and their percentage are mentioned in table.

Table 7.1. UG Verticals

UG Verticals as per GOM GR	Percentage
Basic Science Course & Engineering Science Course	43
Program Courses (PCC & PEC)	17
Multidisciplinary Courses (MDM & OE)	12
Skill Courses (VSEC)	4.5
Humanities Social Science and Management (AEC, EDP, IKS, VEC)	8.5
Experiential Learning Courses (FP, IN, OJT)	12.5
Liberal Learning Courses (CC)	2.5

To ensure equivalence with MSBTE, the NEP-aligned curriculum of the institute adopts MSBTE's nomenclature, as detailed below. Since diploma graduates require a higher level of skill development compared to undergraduates, the proportion of Skill Enhancement and Generic Elective (MDM) courses has been adjusted, prioritizing skill components. The proposed percentage distribution for these

components before finalization of program structure and the actual percentage adopted after finalizing program structure in the NEP-aligned curriculum across various verticals is outlined in the following table.

Table 7.2. Seven Verticals adopted by GPN

GPN Verticals equivalent to MSBTE	Proposed	Actual
DSC = Discipline Specific Courses Core	50%	50.78%
DSE = Discipline Specific Elective	8%	7.03%
GE = Generic Elective	5%	4.68%
AEC = Ability Enhancement Course	5%	3.90%
SEC = Skill Enhancement Course	12%	11.71%
VEC = Value Education Course	8%	7.81%
INP = Internship/Apprentice/Community	12%	14.06%

The curriculum is structured into seven verticals as explained below.

1. Discipline Specific Courses Core (DSC)

These are mandatory courses fundamental to a student's discipline. The aim is to build a strong foundation by covering essential concepts and principles specific to the chosen field of study. DSC courses ensure that students acquire the requisite core competencies for their professional journey.

A total of 19 Discipline Specific Courses Core (DSC) courses has been incorporated into the curriculum to provide in-depth knowledge and hands-on skills in diploma engineering. These courses cover fundamental, applied, and emerging topics essential for diploma students.

2. Discipline Specific Elective (DSE)

DSE courses allow students to explore advanced and specialized areas within their discipline. Offered in the fourth, fifth and sixth semesters, these electives provide deeper insights into specific topics, enabling students to tailor their learning experience based on interests and career goals.

A total of 3 Discipline-Specific Elective (DSE) courses have been incorporated into the curriculum to enhance specialized knowledge and practical skills in diploma engineering. These courses cover advanced, industry-relevant, and emerging topics, allowing students to explore specific areas of interest and improve their employability.

3. Generic Elective (GE)

GE courses promote interdisciplinary and multidisciplinary education and offered in the third, fourth, and fifth semesters. These courses offer students the flexibility to choose subjects beyond their core specialization, fostering broad-based knowledge and skills. The objective is to enhance personal and professional development while encouraging intellectual curiosity. Minor diploma in based on these courses.

A total of 3 Generic Elective (GE) courses has been incorporated into the curriculum, offered in the third, fourth, and fifth semesters for awarding a Minor Diploma. To earn a Minor Diploma alongside their Major Diploma, students must select all three courses from the same discipline. These courses provide interdisciplinary knowledge, industry-oriented skills, and a broader understanding of specialized domains, enhancing career opportunities and academic progression.

4. Ability Enhancement Courses (AEC)

AEC courses aim to strengthen social, communication, and leadership skills essential for personal and professional success. These courses

focus on areas such as language, and communication, empowering students to navigate diverse challenges effectively.

A total of 2 Ability Enhancement Courses (AEC) have been incorporated into the curriculum in the first and second semesters, focusing on Communication Skills and Business Communication. These courses aim to develop students' proficiency in verbal and written communication, workplace etiquette, and professional interaction, enhancing their confidence and employability in technical and business environments.

5. Skill Enhancement Courses (SEC)

Skill Enhancement Courses (SEC) are designed to equip diploma engineering students with practical, hands-on skills in their specialization, combining theoretical knowledge with lab work, training, and fieldwork to meet industry demands.

A total of 7 SEC courses has been incorporated into the curriculum, with at least one course in each semester, ensuring vocational and technical proficiency. These courses emphasize hands-on training, technical expertise, problem-solving, and industry-relevant competencies, preparing students to work effectively as technicians (supervisors). By bridging the gap between theory and practice, SEC courses ensure graduates are job-ready and capable of handling real-world engineering challenges.

6. Value Education Courses (VEC)

VEC courses focus on holistic personality development and instilling ethical, cultural, and constitutional values. These courses encourage critical thinking, teamwork, sportsmanship, and scientific temperament. Topics such as Indian Knowledge Systems, Personality

development, human rights, and Sustainability Development are integral to these courses, ensuring well-rounded growth.

A total of 6 Value Education Courses has been incorporated into the curriculum, with one course in each semester, common to all diploma engineering programs. These courses include Integrated Personality Development, Advanced Personality Development, Yog and Meditation, Environmental Sustainability, Indian Constitution, and Indian Knowledge System. They aim to foster holistic development, ethical values, environmental responsibility, constitutional awareness, and a deeper understanding of India’s rich knowledge traditions, ensuring well-rounded personal and professional growth.

7. Internship/Apprenticeship/Community (INP)

Internship (INP) courses offer experiential learning through professional work environments, providing students with meaningful, practical exposure aligned with their field of study or career aspirations. These structured and credit-bearing internships help students develop industry-relevant skills, build professional networks, and gain real-world experience, effectively bridging the gap between academic knowledge and practical application. By integrating domain-specific expertise, multidisciplinary exposure, skill-building, and values-based education, INP courses ensure holistic learning, aligning with NEP 2020's vision for well-rounded professional and personal development.

Internship courses include summer internships after the second and fourth semesters, along with courses on Industrial Management, Entrepreneurship, and Startups. These courses provide students with practical industry exposure, managerial insights, and entrepreneurial

skills, preparing them for technical roles, leadership positions, and startup ventures.

7.3.2 Outcome-Based Education (OBE)

OBE ensures that the curriculum is designed to achieve predefined outcomes such as skills, competencies, and knowledge levels. This approach shifts the focus from traditional teaching to measurable learning outcomes, preparing students for industry needs and societal contributions. It aligns with NEP's emphasis on learner-centric education and continuous assessment for mastery of concepts. OBE philosophy is explained in details in chapter 3.

7.3.3 Multiple Entry-Multiple Exit (MEME)

The MEME framework allows students to join and exit academic programs at different stages, earning appropriate certification, diploma, or degree based on their completion level. This flexibility caters to diverse learner needs, supports lifelong learning, and provides resilience in adapting to changing career paths or personal circumstances. The details of MEME adopted by GPN is mentioned in table 7.3.

Table 7.3. Multiple Entry-Multiple Exit

Academic Level	Entry Qualification	Exit Qualification	National Credit Level (NCrF)
I Year Diploma Engineering	10 Grade (SSC)	Certificate of Vocation	3.5
II Year Diploma Engineering	I Yr. Diploma / As prescribed by AICTE/State Govt.	Diploma in Vocation	4.0

III Year Diploma Engineering	II Yr. Diploma Engineering	Diploma in Engineering	4.5

The National Credit Framework (NCrF) categorizes education into eight levels, with school education spanning levels 0 to 4. Students who complete Class 5 are placed at Level 1, those passing Class 8 at Level 2, and Class 10 at Level 3. Hence, upon completing three-year diploma in engineering, students reach Level 4.5 as mentioned in table 7.2.

7.4 Lateral Entry (As per AICTE/State Govt. Guidelines)

Lateral entry provisions enable diploma holders and other eligible candidates to enter higher semesters of degree programs, promoting vertical mobility in education. This feature, guided by AICTE and state policies, aligns technical education pathways, recognizing prior learning and practical experience as integral to academic progression.

7.5 Credit-based System

A credit-based system quantifies learning achievements, making the academic workload transparent and transferable. It supports flexible learning pathways, aids in credit accumulation and transfer, and aligns Indian education with global standards, thereby fostering student mobility and lifelong learning.

In the credit system, credits serve as formal recognition of a student's completion of prior learning that aligns with a specific qualification level. Under the NCrF framework, one credit corresponds to 30 notional learning hours.

Each semester, a student must earn a minimum of 20 credits, amounting to at least 40 credits per year, corresponding to 1,200

notional learning hours. However, students have the flexibility to earn more than the minimum required credits within a year as per NCrF framework.

To complete the Diploma in Engineering at GPN, students must earn a total of 128 credits. The credit distribution across semesters is as follows: Semester I – 20 credits, Semester II – 20 credits, Semester III – 22 credits, Semester IV – 22 credits, Semester V – 22 credits, and Semester VI – 22 credits, as detailed in the table 6.1 and the detailed program structure mentioned later on.

7.6 Industrial Training

Mandatory industrial training for 15 weeks bridges the gap between academic learning and real-world application. It immerses students in industry practices, enhances employability skills, and provides practical insights into their disciplines, aligning with NEP's focus on experiential and vocational learning.

As per the directives of the Directorate of Technical Education (DTE), industrial training as internship must have a duration of 16 weeks. In accordance with the AICTE internship policy, the proposed schedule is as follows:

i) 4 weeks during the summer vacation after the completion of the Second Semester Examination.

ii) 12 weeks from 16th May to 15th August following the Fourth Semester Examination.

7.7 Self-Study Learning & Its Assessment

Incorporating self-study components encourages independent learning, critical thinking, and time management skills. Structured

assessments ensure accountability and validate the knowledge gained, promoting a culture of self-driven education and lifelong learning as envisioned in NEP 2020.

Self-study learning hours are included in the credit calculation; however, they do not contribute to the faculty's workload. Nevertheless, faculty members should guide students during their self-study and conduct a summative assessment to evaluate their learning progress.

7.8 Inclusion of Spoken Tutorials and NPTEL Courses

The integration of Spoken Tutorials by IIT Mumbai and NPTEL courses provides access to high-quality, standardized online learning resources. These platforms enhance conceptual understanding and technical skills, supporting NEP's vision of leveraging technology for inclusive and equitable education.

Every student must register for the **"**Basics of Computer**"** course under IIT Bombay's Spoken Tutorial program during their course of study, as specified in the program structure. The course must be completed under the mentorship of department faculty. The related guidelines are mentioned elsewhere in this document.

A student may register for an NPTEL course with a minimum duration of 8 weeks as a generic elective course from any discipline. However, they must submit the completion certificate to acquire the credits specified in the program structure. For obtaining a minor diploma, students are required to complete three NPTEL courses from the same discipline.

7.9 One Skill Enhancement Course (SEC) in Every Semester

Including at least one SEC per semester ensures continuous skill development, making students industry-ready. These courses focus on technical, vocational, and soft skills, bridging the gap between theoretical knowledge and practical application. (Explained in 7.3.1 (5))

7.10 One Value Education Course (VEC) in Every Semester

VECs foster ethical awareness, social responsibility, and personal development. By embedding value-based education in every semester, the curriculum nurtures compassionate and socially conscious individuals, in line with NEP's holistic education goals. (Explained in 7.3.1 (6))

7.11 Generic Elective Courses

Offering multidisciplinary Generic Elective courses in the middle semesters allows students to explore interests beyond their core discipline. This flexibility fosters innovation, broadens perspectives, and supports the concept of a Minor Diploma, enriching the academic experience. (Explained in 7.3.1 (3))

7.12 Introduction of Notional Hours

Notional hours represent the total estimated time a student spends on all academic activities, including lectures, practical, assignments, and self-study. Establishing a minimum of 600 notional hours per semester ensures a well-rounded academic workload, fostering deeper engagement and comprehensive learning.

7.13 Award of Certificate/Diploma

As the Multiple-Entry Multiple-Exit (MEME) system is implemented at GPN, the awarding of certificates and diplomas is based on the percentage of marks obtained by students upon completing the total credits outlined in the program structure, as follows:

1. **Certificate in Vocation** – Based on the percentage of marks obtained in the first and second semesters, including the exit course.
2. **Diploma in Vocation** – Based on the percentage of marks secured in the third and fourth semesters, including the exit course.
3. **Diploma in Engineering** – Based on the percentage of marks achieved in the fifth and sixth semesters.

7.14 Conclusion

NEP 2020-aligned curriculum represents a paradigm shift in education, focusing on fostering critical thinking, practical skills, and holistic development. By incorporating flexibility, technology, and diverse learning opportunities, it empowers students to thrive in a rapidly changing world. Through its innovative features, this curriculum ensures that learners are equipped with the knowledge, skills, and values needed for personal growth, professional success, and societal contributions, fulfilling the vision of NEP 2020.

CHAPTER 8

Course Curriculum

The Model Course Curriculum for one course, developed by the CDC of GPN, is circulated among various programs for curriculum development. A workshop is organized to explain the contents of the curriculum, providing further insights into its structure and implementation for academic enhancement. The details are described below.

8.1 Basic Information

EE204H **2023 CURRICULUM**

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in Electrical Engineering
Course Category	:	DSC
Course Code	:	EE204H
Course Title	:	DC Machines and Transformers

Figure 8.1. Basic Information

8.1.1 Program

Government Polytechnic, Nagpur offers thirteen diploma engineering programs, with their respective abbreviations listed below.

Civil Engineering- CE

Mechanical Engineering- ME

Electrical Engineering- EE

Electronics and Telecommunication Engineering- EC

Packaging Technology- PK

Metallurgical Engineering- MT

Information Technology- IT

Automobile Engineering- AE

Computer Engineering- CM

Travel and Tourism- TR

Textile Manufacture- TX

Mechatronics Engineering- MK

Artificial Intelligence & Machine Learning- AI

8.1.2 Course Category

As per the National Education Policy 2020, the institute has adopted seven verticals as course categories, mentioned in 7.3.1.

8.1.3 Course Code

A unique method has been developed for assigning course codes to various courses, as illustrated in the figure 8.2.

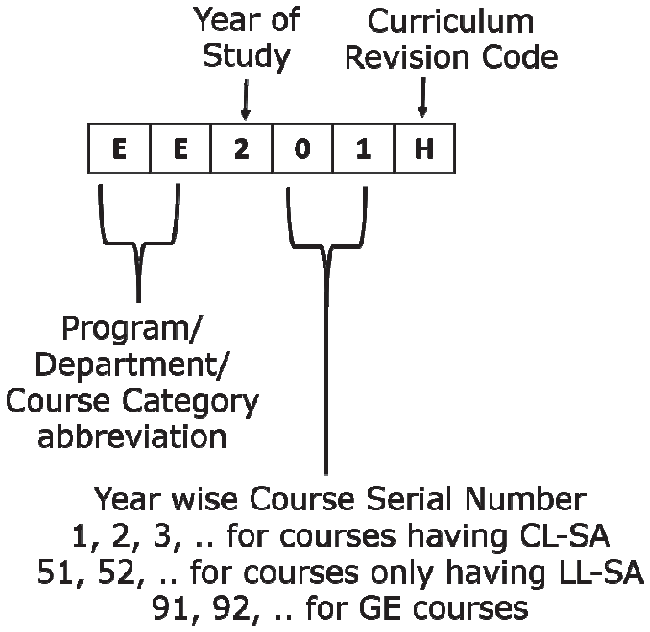

Figure 8.2. Course Code Details

Program codes are mentioned above, however department and other codes for common courses are as follows:

Departments:

English- EN

Mathematics- MH

Physics-PH

Chemistry-CH

Workshop-WS

Applied Mechanics-AM

Hotel Management- HM

Other Codes:

Value Education- VE

Internship/Management- IN

8.1.4 Course Title

The course title provides a concise and descriptive name that reflects the primary focus and objectives of the course. It serves as an identifier for students and educators, ensuring clarity and alignment with the course content and learning outcomes. A course is designed based on an industry-identified competency.

8.2 Rationale

The rationale of a curriculum explains the purpose and importance of the course or program. It outlines how the curriculum aligns with educational goals, addresses the needs of students, industry, and society, and supports the development of skills and knowledge. It serves as a foundation for curriculum design and implementation.

I Rationale:

This course deals with basics of DC machines and transformers. Students will learn to choose the right machines and transformers for different needs. They'll able to differentiate between special and conventional transformers. These are crucial in power systems for generating, transmitting, and distributing electricity. Students will apply this knowledge in studying courses like power system management, equipment operation, and maintenance. They'll use these skills in roles like supervisors, controllers, and technicians..

Figure 8.3. Rationale

8.3 Industry-identified competency

Industry-identified competencies in a curriculum refer to the specific skills, knowledge, and abilities that are recognized as essential by industry professionals. These competencies ensure that students are equipped with practical, relevant expertise to meet the demands of the workforce, fostering employability and bridging the gap between academic learning and real-world applications.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Operate and maintain DC machine and transformers for electrical systems.

Figure 8.4. Industry-identified Competency

8.4 Course Outcomes (COs)

Course Outcomes (COs) are considered the "building blocks" of the Outcome-Based Education (OBE) system. They are measurable statements that define the knowledge, skills, and abilities students are expected to achieve by the end of the course. COs are aligned with Program Outcomes (POs) and are linked to assessments that evaluate

student performance. Typically, every course has six COs, and these outcomes are closely related to the desired graduate attributes.

In OBE, Bloom's Taxonomy plays a significant role in shaping COs, focusing on higher-order thinking skills rather than just recalling facts. COs are written at higher levels of learning, ensuring that students can apply, analyze, and synthesize information. They are based on all domains of learning—cognitive, psychomotor, and affective—to achieve a comprehensive set of POs. Each CO begins with an action verb, emphasizing active learning.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** the suitable DC generator as per requirement.

CO2: **Suggest** the suitable D.C motor on the basis of applications.

CO3: **Analyse** different parameters obtained from various tests on transformer.

CO4: **Recommand** special transformer for perticular application.

CO5: **Suggest** the suitable three-phase transformer for various applications.

CO6: **Operate** single-phase and three-phase transformers in parallel for load sharing.

Figure 8.5. Course Outcomes

Course Outcomes (COs) are designed based on industry-identified competencies and are specified for each unit.

Example COs:

- "Analyze electrical circuits to identify faults" (Cognitive Domain).

- "Design and build a simple electrical prototype" (Psychomotor Domain).
- "Practice electrical circuits for lighting" (Affective Domain).

8.5 Learning Scheme

Each curriculum is designed for 15 weeks, and for calculations under the National Credit Framework (NCrF), 30 notional learning hours are equivalent to one credit. For instance, if a course involves a total of 6 learning hours per week, this translates to 90 notional hours over the duration of the course, resulting in a total of 3 credits.

As per National Education Policy 2020, the total outcome-based learning hours for credits shall, subject to assessment, include: Classroom Learning (CL), Tutorial Learning (TL)/Laboratory Learning (LL), and Self-study Learning (SL).

8.5.1 Classroom Learning (CL)

Classroom learning is a structured educational process that occurs in a formal setting, typically led by an instructor or teacher. It focuses on the delivery of theoretical knowledge and conceptual understanding.

8.5.2 Laboratory Learning (LL)

Laboratory learning provides hands-on experience to reinforce theoretical concepts through practical application. It is essential for technical and engineering education.

8.5.3 Tutorial Learning (TL)

Tutorial Learning (TL) emphasizes interactive sessions, allowing students to clarify concepts, engage in discussions, and solve problems with personalized guidance.

8.5.4 Self-Study Learning (SL)

Self-study is a personalized learning process where students take initiative to acquire knowledge independently. It complements classroom and laboratory learning.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

Figure 8.6. Learning Scheme

8.6 Assessment Scheme

Assessment scheme consists of formative and summative assessment as specified in respective curriculum.

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

Figure 8.7. Assessment Scheme

8.6.1 Formative Assessment (FA)

Formative assessment is a continuous evaluation process aimed at monitoring student learning and providing ongoing feedback to improve teaching and learning.

8.6.2 Summative Assessment (SA)

Summative assessment evaluates student learning at the end of a course, unit, or academic period. It focuses on measuring outcomes against predefined standards.

8.7 Classroom Learning Content

Classroom learning content is structured into five or six units, each comprising topics and subtopics. Specific Learning Outcomes (SLOs) in the cognitive domain are defined based on the Course Outcomes (COs) and learning content. Action verbs from higher levels of the cognitive domain—Apply, Analyze, Evaluate, and Create—are utilized to align the SLOs with the Course Outcomes (COs).

8.7.1 Specific Learning Outcomes

Specific Learning Outcomes (SLOs) are defined as "statements describing what students are expected to achieve as a result of a learning activity," such as at the end of a unit, chapter, or practical session. SLOs should represent assessable and measurable knowledge, skills, abilities, or attitudes that students acquire by the conclusion of the sub-topic or practical.

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: DC Generator	1a	Select the laws suitable for dc machines operation	1.1	Introduction to DC and AC.Machines, types of DC and AC machines, Principle of DC motor and DC Generator,Fleming's Right hand rule, Flemings Left hand rule.	CO1
	1b	Suggest the materials used for given parts of dc machines with justification	1.2	Construction of DC machines,Different parts of D.C.Machines and their functions, Different materials used for the parts of DC machines.	
	1c	Calculate EMF induced in DC generator on the given data.	1.3	Types of Armature windingLap and Wave windings, EMF equation.Calculate the emf induced in the generator	
	1d	Select the suitable DC generator as per given requirement	1.4	Symbolic representation of a generator,Types of DC generator and Load characteristics of separetly excited and self excited DC generators, Various losses inDC generator. efficiency of generator (No Numericals) and their applications.	

Figure 8.8. Classroom Learning Content

8.8 Laboratory Learning Content

Laboratory learning content is organized into five or six units, with all Specific Learning Outcomes (SLOs) focused on the psychomotor domain at higher levels. These SLOs are aligned with the Course Outcomes (COs) to develop practical skills as per industry-identified

competency. Each SLO will be assessed formatively, and summative assessment will be conducted using rubrics.

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify different parts and windings of DC machine.	2	CO1
I	2	Find the value of critical resistance of DC shunt generator by plotting OCC	2#	CO1
I	3	Perform load test on DC shunt generator.Plot internal and external characteristics of DC shunt generator	2#	CO1

Figure 8.9. Laboratory Learning Content

8.9 Self-Study Learning (SLO in Cognitive / Psychomotor / Affective Domain)

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a microproject on small dc generatorand prepare report.
2. Draw the constructional diagram of DC machine showing various parts and write their functions along with materials used for the different parts.prepare report.

Figure 8.10. Self-Study Learning Content

Self-study learning content is structured into 10 to 15 activities, with all Specific Learning Outcomes (SLOs) targeting higher levels of the Cognitive, Psychomotor, or Affective domains. Learners will select and complete one activity under the guidance of a faculty mentor. Summative assessment will be conducted by the faculty using rubrics.

8.10 Specification Table for Classroom Learning Assessment

The specification table serves as a blueprint for designing a valid question paper. In the curriculum, it is included to guide both question paper setting and student preparation. The table highlights level-wise cognitive process dimensions across three levels: Remember (R), Understand (U), and Apply/Higher Level (A).

The suggested distribution of levels is as follows: Remember (R) – 20%, Understand (U) – 30%, and Apply/Higher Level (A) – 50%.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	DC Generator	5	C	02	04	00	06
			O	00	00	06	06
2	D.C. Motor	10	C	02	04	06	12
			O	02	04	04	10
3	Single phase transformer	8	C	06	04	06	16
			O	04	04	00	8
4	Special transformer	6	C	00	08	00	08
			O	02	04	00	06
5	Three phase transformer	10	C	02	04	10	16
			O	00	04	00	04
6	Parallel operation of transformers	6	C	02	04	06	12
			O	00	00	06	06
Total		45	C	14	28	28	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

Figure 8.11. Specification Table

8.11 Question Paper Format for Summative Assessment (SA)

The Question Paper Profile (QPP) is a tool that facilitates the implementation of e-governance in the question paper-setting process. By using QPP along with a question bank for each component, a question paper can be generated through a computer program. QPP serves as a ready reckoner for setters, enabling them to create questions across different cognitive domain levels and topics. It significantly reduces the time required to prepare printed question papers for classroom learning summative assessments.

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	5R2	6R2	2R2	4R2	5	7
2	2U4	1U4	3R4	4U4	3R4			3	5
3	3U4	4U4	5U4	5U4	2A4			3	5
4	4U4	6U4	5A4	2U4	3U4			3	5
5	3A6	2A6	1A6					2	3
6	5A6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

Figure 8.12. Question Paper Profile

8.12 Scheme of Laboratory Formative Assessment (FA)

A maximum of four criteria are defined in the curriculum for the formative assessment of laboratory learning. Each SLO will be

assessed by faculty using rubrics, which are based on the criteria outlined in the curriculum.

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

Figure 8.13. Scheme of Laboratory Formative Assessment

8.13 Scheme of Self-Learning Summative Assessment (SA)

A maximum of four criteria are defined in the curriculum for the summative assessment of self-study learning. The activity performed by the learner will be evaluated by the faculty using rubrics, based on the criteria specified in the curriculum.

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment, survey	5
2	Performance, collection of literature	10
3	fabrication, Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

Figure 8.14. Scheme of Laboratory Formative Assessment

8.14 COs-POs/PSOs Mapping Matrix

A curriculum map helps identify the program's strengths (attributes widely addressed) and gaps (attributes addressed by only a few learning experiences). The simplest form of a curriculum map is a matrix, where the rows represent learning experiences (Course Outcomes), and the columns represent Program Outcomes (or Graduate Attributes). The seven Program Outcomes for diploma engineering courses, as defined by the National Board of Accreditation, serve as the columns. The strength of mapping is categorized into three levels: Low (1), Medium (2), and Strong (3).

CO-PO mapping is conducted by a group of faculty members using the method established by the Curriculum Development Cell.

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	2	3	-	-
CO2	3	-	-	3	-	2	3	-	-
CO3	3	-	-	3	-	2	3	-	-
CO4	3	-	-	3	-	-	3	-	-
CO5	3	-	-	3	-	-	3	-	-
CO6	3	-	-	3	-	-	3	-	-

Figure 8.15. COs-POs/PSOs Mapping Matrix

8.15 Textbooks, BIS Codes References

The reference books, textbooks, and standards needed for the curriculum content are provided as resources for both students and faculty. Only standard books with ISBN numbers are given priority in the curriculum document.

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Electrical Machines	S.K. Bhattacharya, The McGraw Hill companies, Seventh Reprint, 2011.	13:978-007-0669215 10:0-07-066921-X
2	Principle of Electrical Machines	V K Mehta, Rohit Mehta, S. Chand Publishing, 2nd Edition,2002	9788121921916

Figure 8.16. Textbooks, BIS Codes References

8.16 e-References

E-references are included in the curriculum to serve as valuable resources for both students and faculty. Priority is given to standard and credible e-references to ensure quality and reliability. These references are carefully selected to enhance students' learning experience and support their academic growth.

XV e-References:

1. http://nptel.ac.in/courses/108108076/1 , accessed on 29th April 2024
2. https://www.youtube.com/watch?v=-xebh8wU8gY accessed on 29th April 2024

Figure 8.17. e-References

8.17 List of Major Equipment/Machineries with Specification

The document includes a detailed list of major equipment and instruments necessary for conducting practical exercises aimed at developing psychomotor skills. The listed equipment and instruments are integral to facilitating effective practical sessions, enabling students to gain proficiency and confidence in applying theoretical concepts to real-world scenarios.

XVI List of Major Equipment/Machineries with Specification:

1. Auto transformer (Dimmerstat), single-phase, Input-240 V, Output 0-270 V,
2. Auto transformer (Dimmerstat), three-phase, Input-440 V, Output 0-440 V
3. D.C. Shunt, Series and Compound Generators, Voltage rating 220 Volts,
4. D.C. Shunt and Series Motors, Voltage rating 220 Volts, Power rating 2 KW

Figure 8.18. List of Major Equipment/Machineries

8.18 List of Industry Experts and Faculties who contributed for this curriculum

The document includes a list of experts and faculty members who contributed to the development of the curriculum. Their valuable inputs and expertise have ensured the curriculum's relevance and quality. The document is authenticated with the signatures of the Chairman and Member Secretary of the Program Board of Studies (PBOS), underscoring its credibility and approval.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M.B.Daigavane	Principal	Government Polytechnic, Nagpur
2	Dr.P. M.Daigavane	H.O.D. Electrical Engineering, Academic Expert.	G.H.Raisoni College of Engineering, Nagpur
3	Mrs. Divya Piprode	Sr. Engineer, Industry Expert	PGCIL, Nagpur
4	Mr. M.N. Gawande	Lecturer in Electrical Engineering, MSBTE Nominee.	Government Polytechnic, Gondia
5	Dr G.V.Gotmare	I/C HoD, Electrical Engineering	Government Polytechnic, Nagpur
6	Mrs. A. A. Alegaonkar	Lecturer in Electrical Engineering, Course Incharge	Government Polytechnic, Nagpur

(Dr.G.V.Gotmare)
HOD & Chairman PBOS,

(Dr. G. V. Gotmare)
Member Sectretary PBOS,

Figure 8.19. List of Industry Experts and Faculties

CHAPTER 9

Curriculum Document

Detailed curriculum document of Diploma in **Civil Engineering** is given below.

9.1 Vision of Institute

To become a Center of Excellence, providing quality technical education and training

9.2 Mission of Institute

The mission of Government Polytechnic, Nagpur is-

1. To frame institutional policies for effective implementation of teaching learning process
2. To inculcate values and ethics for life-long learning through curricular, co-curricular and extra-curricular activities
3. To develop facilities and services for academic excellence
4. To enhance the skills of faculties and staff through industry institute collaboration.

9.3 Vision of Program

Vision of the Civil Engineering Program:

"To impart knowledge and excellence in civil engineering and technology with global perspectives to our students and to make them ethically strong engineers to build our Nation"

9.4 Mission of Program

Mission of the Civil Engineering Program:

M1. To produce civil engineers of high caliber, technical skills and ethical values to serve the Society and nation.

M2. To create competent professionals who are trained in the design, estimate, and development of civil engineering systems.

M3. To promote innovative and original thinking in the minds of budding engineers to face the challenges of future.

M4. To provide essential knowledge & skill to the students and enhance their employable potential and entrepreneurial capabilities.

9.5 Program Educational Objectives (PEOs)

The Program Educational Objectives of (PEOs) Civil Engineering Program are:

PEO1. To create civil engineering professionals ready for industry, government or other Organizations by implementing efficient civil engineering practices.

PEO2. To Make use of formal and informal learning opportunities to sustain and improve technical, Personal and professional growth and get various licensure

PEO3. To develop professional skills and by using modern tools in civil engineering

PEO4. To relate broad civil engineering education for effective communication of civil Engineering concepts orally and in written forms.

PEO5. To guide principles of sustainable development and to

promote the students for continuous Learning and development with professional moral and ethical values.

Program Outcomes (POs)

PO1: Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

9.6 Program Specific Outcomes (PSOs)

PSO1: Construct, and maintain roads, bridges, irrigation structures and buildings.

PSO2: Use appropriate techniques to test the civil engineering materials.

9.7 Mapping of Vision, Mission, PEOs, POs, PSOs

9.7.1 Mapping of Vision and Mission

Table 9.1. Mapping of Vision-Mission

	Mission Statements			
	M1	M2	M3	M4
Vision Statement	✓	✓	✓	✓

9.7.2 Mapping of Mission and PEOs

Table 9.2. Mapping Mission-PEOs

Mission Statements	**Program Educational Objectives (PEOs)**				
	PEO1	**PEO2**	**PEO3**	**PEO4**	**PEO5**
M 1	✓	✓	✓	✓	✓
M 2	✓	✓	--	--	✓
M 3	✓	✓	✓	✓	✓
M 4	--	✓	✓	✓	✓

9.7.3 Mapping of PEOs and POs- PSOs

Table 9.3. Mapping PEOs-POs & PSOs

PEOs	Program Outcomes (POs)							PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
PEO1	✓							✓	
PEO2		✓	✓	✓			✓		✓
PEO3		✓	✓	✓			✓		✓
PEO4							✓	✓	
PEO5					✓	✓		✓	

9.8 Industry Identified Competencies in Search Conference

S.N.	Competencies (What diploma holders will be able to do in the industry at entry level) Legends: ME-Most Essential, E-Essential, D-Desirable, NR-Not Required	ME	E	D	NR	Total	Score	Rank
1	Use modern survey instruments for surveying and mapping	41	8	1	2	52	3.71	1
2	Use computers for documentation, presentation, analyze data and Internet services.	43	4	2	3	52	3.69	2
3	Conduct materials testing and quality control.	39	10	2	1	52	3.69	3
4	Conduct accurate land survey and prepare maps; Prepare L sections, Cross Sections and contour maps	42	5	4	1	52	3.69	4
5	Suggest and use relevant grade of concrete for given work	38	11	2	1	52	3.67	5
6	Use basic principles in civil engineering for different applications.	37	12	2	1	52	3.65	6

7	Manage and supervise construction activities	36	12	4	0	52	3.63	7
8	Estimate accurate quantities of items and costs for construction projects.	34	16	1	1	52	3.61	8
9	Select construction materials as per properties and required applications	35	14	3	1	52	3.59	9
10	Ensure compliance with building codes and regulations and Prepare submission drawings	34	15	2	1	52	3.59	10
11	Use different engineering tools for performing construction site activities.	37	10	2	3	52	3.57	11
12	Communicate technical information clearly and effectively.	34	14	3	1	52	3.57	12
13	Prepare contract documents for civil engg works	32	17	2	1	52	3.55	13
14	Analyze soil behavior and apply it to engineering projects.	32	17	2	1	52	3.55	14
15	Plan, execute, and manage civil engineering projects effectively	34	12	5	1	52	3.53	15
16	Construct and maintain highways and pavements.	33	13	4	2	52	3.49	16
17	Analyze the structure for shear stresses , bending stresses, slopes and deflections	33	14	3	2	52	3.49	17
18	Prioritize safety in construction practices.	31	16	4	1	52	3.49	18
19	Design and maintain simple hydraulic systems, including pipelines and water distribution.	32	14	4	2	52	3.47	19
20	Identify and mitigate risks in construction projects.	31	16	3	2	52	3.47	20
21	Demonstrate leadership qualities in project management.	31	16	5	1	52	3.47	21
22	Build positive relationships and work effectively with colleagues and stakeholders.	34	10	6	2	52	3.47	22

23	Apply critical thinking and problem-solving skills to engineering challenges.	31	15	4	2	52	3.45	23
24	Manage and supervise water treatment and distribution systems.	33	12	4	3	52	3.45	24
25	Manage time efficiently to meet project deadlines and goals.	32	14	3	3	52	3.45	25
26	Use CAD and Building Information Modeling (BIM) software for design and documentation.	32	13	4	3	52	3.43	26
27	Inspect and assess existing structures for safety and compliance. Develop maintenance plans for infrastructure.	28	20	2	2	52	3.43	27
28	Manage effectively construction projects, including scheduling and budgeting.	31	14	5	2	52	3.43	28
29	Identify and use alternate building materials	29	17	4	2	52	3.41	29
30	Analyze data to draw meaningful conclusions and insights.	31	14	4	3	52	3.41	30
31	Monitor and ensure the quality of construction work, materials, and processes to meet industry standards and project specifications.	30	15	5	2	52	3.41	31
32	Address environmental concerns and design sustainable solutions.	29	18	1	4	52	3.39	32
33	Consider environmental impact in their civil engineering practices.	29	17	3	3	52	3.39	33
34	Apply green technologies in planning and execution of building projects	29	17	2	4	52	3.37	34
35	Consider sustainability principles in project decision-making.	29	15	6	2	52	3.37	35
36	Manage water resources, including dams and irrigation systems.	27	18	5	2	52	3.35	36
37	Demonstrate a commitment to lifelong learning and professional development.	29	17	2	4	52	3.35	37

38	Communicate effectively with the public and stakeholders.	27	16	8	1	52	3.33	38
39	Adapt to evolving technologies and innovate in engineering solutions.	28	16	5	3	52	3.33	39
40	Test various parameters of different construction materials	27	18	4	3	52	3.33	40
41	Respond effectively to construction-related emergencies.	27	16	7	2	52	3.31	41
42	Analysis and provide solutions to civil engg problems	26	19	4	3	52	3.31	42
43	Manage and supervise transportation systems and infrastructure.	26	18	5	3	52	3.29	43
44	Design canals for require discharges	27	15	6	4	52	3.25	44
45	Make sound decisions based on data and analysis.	27	17	2	6	52	3.25	45
46	Identify and address the root causes of civil system issues.	26	18	2	6	52	3.24	46
47	Apply the concept of Mathematics to solve industry-based technology problems	24	16	10	2	52	3.22	47
48	Select suitable types of pump for required purposes	26	15	8	3	52	3.22	48
49	Prepare SWM plan for city / town	23	19	7	3	52	3.20	49
50	Engage with communities affected by construction projects.	25	14	9	4	52	3.16	50
51	Measure various parameters in water and wastewater analysis.	25	15	7	5	52	3.16	51
52	Prepare engineering drawing using prevailing drawing instruments.	25	12	10	5	52	3.12	52
53	Apply principles of physics to solve broad based relevant engineering problems.	24	11	12	5	52	3.06	53

54	Measure various parameters in hydraulic systems.	24	11	10	7	52	3.00	54
55	Respect cultural diversity in engineering projects.	12	31	5	4	52	2.96	55
56	Use constitutional Provisions in society	16	20	13	3	52	2.94	56
57	Use basic Electrical/ Mechanical and Automobile engg knowledge for solving problems at site	15	22	11	4	52	2.92	57
58	Operate and maintain construction equipment such as excavators, bulldozers, cranes, and concrete mixers.	19	14	12	7	52	2.86	58
59	Use ancient Indian knowledge system for providing solutions to local problems	12	20	14	6	52	2.71	59
60	Apply principles of chemistry to solve broad based relevant engineering problems.	10	12	21	9	52	2.45	60

Technical Skills Required for Diploma in Civil Engineering

S.N.	**Technical Skills (What diploma holders will be able to do in the industry at entry level) Legends: ME-Most Essential, E-Essential, D-Desirable, NR-Not Required**	**ME**	**E**	**D**	**NR**	**Total**	**Score**	**Rank**
1	Monitor and ensure the quality of construction work, materials, and processes to meet industry standards and project specifications.	38	14	0	0	52	3.75	1
2	Manage construction sites effectively, including organizing	40	9	3	0	52	3.73	2

	resources, scheduling work, and ensuring safety and compliance							
3	Place and lay steel reinforcement bars (rebar) to reinforce concrete structures like beams, columns, and foundations.	35	14	3	0	52	3.66	3
4	Use computer-aided design (CAD) software like AutoCAD and civil engineering software for drafting and designing construction plans.	37	10	5	0	52	3.63	4
5	Analyze and design structural elements and systems, including beams, columns, and trusses.	31	21	0	0	52	3.61	5
6	Lay bricks, blocks, and other masonry materials to construct walls, partitions, and structural components.	31	18	3	0	52	3.55	6
7	Conduct land surveys, using surveying instruments, and accurately measuring land and construction sites.	32	17	2	1	52	3.55	7
8	Undertake hands-on experience in mixing, pouring, and finishing concrete for various construction elements, such as foundations, slabs, and columns.	35	9	8	0	52	3.53	8
9	Operate and maintain construction equipment such as excavators, bulldozers, cranes, and concrete mixers.	29	20	3	0	52	3.51	9
10	Create accurate project documentation, including drawings, reports, and records.	32	16	2	2	52	3.51	10

11	Perform tests on construction materials like concrete, asphalt, and soil to ensure quality and compliance with specifications.	21	20	8	3	52	3.14	11
12	Conduct soil tests and investigations to assess soil properties for foundation design and ground improvement.	17	23	7	5	52	3.00	12

9.9 Courses Identification

Courses are formed based on feedback obtained from alumni and industries, industry identified competencies finalized in search conference, and identified gaps previous curriculum, NEP and AICTE guidelines and institute policy framed by ILC. The following table shows various courses formed based on identified competencies.

Table 9.4. Courses Identification from Identified Competencies.

S.N.	Competencies (What diploma holders will be able to do in the industry at entry level)	Rank based on Industry Feedback	Name of Course to be introduced in Curriculum	Course Category DSC/DSE/ SEC/AEC/ VEC/INP etc.	Semester of the course
1	Use modern survey instruments for surveying and mapping	1	Advanced Surveying	SEC	IV
2	Use computers for documentation, presentation, analyze data and Internet services.	2	Basics of Computers	SEC	I
3	Conduct materials testing and quality control.	3	Mechanics of Structure	DSC	III
4	Conduct accurate land survey and prepare maps; Prepare L sections, Cross	4	Surveying	DSC	III

	Sections and contour maps				
5	Suggest and use relevant grade of concrete for given work	5	Concrete Technology	DSC	III
6	Use basic principles in civil engineering for different applications.	6	Internship Basic	INP	II, III
7	Manage and supervise construction activities	7	Building Construction	DSC	II
8	Estimate accurate quantities of items and costs for construction projects.	8	Estimating And Costing	SEC	V
9	Select construction materials as per properties and required applications	9	Construction Materials	DSC	II
10	Ensure compliance with building codes and regulations and Prepare submission drawings	10	Building Drawing with CADD	SEC	III
11	Use different engineering tools for performing construction site activities.	11	Civil Engineering Workshop Practices	SCE	I
12	Communicate technical information clearly and effectively.	12	Communicati on Skills	VEC	II
13	Prepare contract documents for civil engg works	13	Contracts and Accounts	DSC	VI
14	Analyze soil behavior and apply it to engineering projects.	14	Geotechnical Engineering	DSC	IV
15	Plan, execute, and manage civil engineering projects effectively	15	Capstan Project	SEC	VI
16	Construct and maintain highways and pavements.	16	Highway Engineering	DSC	III
17	Analyze the structure for shear stresses , bending stresses,	17	Theory of Structures	DSC	IV

	slopes and deflections				
18	Prioritize safety in construction practices.	18	Industrial Management	INP	V
19	Design and maintain simple hydraulic systems, including pipelines and water distribution.	19	Hydraulics	DSC	V
20	Identify and mitigate risks in construction projects.	20	Capstan Project	SEC	VI
21	Demonstrate leadership qualities in project management.	21	Industrial Management	INP	V
22	Build positive relationships and work effectively with colleagues and stakeholders.	22	Integrated Personality Development	VEC	I
23	Apply critical thinking and problem-solving skills to engineering challenges.	23	Advanced Personality Development	VEC	II
24	Manage and supervise water treatment and distribution systems.	24	Environmental Engineering	DSC	VI
25	Manage time efficiently to meet project deadlines and goals.	25	Business Communication	AEC	II
26	Use CAD and Building Information Modeling (BIM) software for design and documentation.	26	Engineering Graphics Civil	SEC	II
27	Inspect and assess existing structures for safety and compliance. Develop maintenance plans for infrastructure.	27	Maintenance & Repairs of Structures	DSE	IV
28	Manage effectively construction projects, including scheduling and budgeting.	28	Internship and Start up	INP	Vi
29	Identify and use alternate building materials	29	Deleted as per BOS instruction		

30	Analyze data to draw meaningful conclusions and insights.	30	Capstan Project	SEC	VI
31	Monitor and ensure the quality of construction work, materials, and processes to meet industry standards and project specifications.	31	Internship and Start up	INP	Vi
32	Address environmental concerns and design sustainable solutions.	32	Environment al Sustainability	VEC	IV
33	Consider environmental impact in their civil engineering practices.	33	Environment al Sustainability	DSC	II
34	Apply green technologies in planning and execution of building projects	34	Deleted as per BOS suggestions		
35	Consider sustainability principles in project decision-making.	35	Entrepreneur ship and Start up	INP	VI
36	Manage water resources, including dams and irrigation systems.	36	Water Resources Engineering	DSE	VI
37	Demonstrate a commitment to lifelong learning and professional development.	37	Entrepreneur ship and Start up	INP	VI
38	Communicate effectively with the public and stakeholders.	38	Deleted as per BOS suggestions		
39	Adapt to evolving technologies and innovate in engineering solutions.	39	Deleted as per BOS suggestions		
40	Test various parameters of different construction materials	40	Deleted as per BOS suggestions		
41	Respond effectively to construction-related emergencies.	41	Deleted as per BOS suggestions		
42	Analysis and provide solutions to civil engg problems	42	Applied Mathematics	DSC	II

43	Manage and supervise transportation systems and infrastructure.	43	Traffic Engineering	DSE	IV
44	Design canals for require discharges	44	Deleted as per BOS suggestions		
45	Make sound decisions based on data and analysis.	45	Deleted as per BOS suggestions		
46	Identify and address the root causes of civil system issues.	46	Deleted as per BOS suggestions	-	-
47	Apply the concept of Mathematics to solve industry-based technology problems	47	Basic Mathematics	DSC	I
48	Select suitable types of pump for required purposes	48	Hydraulics	DSC	V
49	Prepare SWM plan for city / town	49	Solid Waste Management	DSC	V
50	Engage with communities affected by construction projects.	50	Deleted as per BOS suggestions		
51	Measure various parameters in water and wastewater analysis.	51	Deleted as per BOS suggestions		
52	Prepare engineering drawing using prevailing drawing instruments.	52	Deleted as per BOS suggestions		
53	Apply principles of physics to solve broad based relevant engineering problems.	53	Applied Physics	DSC	II
54	Measure various parameters in hydraulic systems.	54	Deleted as per BOS instruction		
55	Respect cultural diversity in engineering projects.	55	Advanced Personality Development	VEC	II
56	Use constitutional Provisions in society	56	Indian Constitution	VEC	V

57	Use basic Electrical/ Mechanical and Automobile engg knowledge for solving problems at site	57	Generic Elective	GE	III
58	Operate and maintain construction equipment such as excavators, bulldozers, cranes, and concrete mixers.	58	Deleted as per BOS suggestions		
59	Use ancient Indian knowledge system for providing solutions to local problems	59	Indian Knowledge System	VEC	VI
60	Apply principles of chemistry to solve broad based relevant engineering problems.	60	Applied Chemistry	DSC	I

9.10 Program Structure

The program structure of the Civil Engineering program is developed as described previously and is given in appendix.

APPENDIX A Curriculum

Appendix I

Curriculum

Program Structure

Government Polytechnic, Nagpur

Diploma in Civil Engineering

NEP 2020 Align Curriculum 2023 Program Structure

Semester: First

SN	Course Code	Course Title	Course Category	Learning Scheme (Hours/Week)				Notional Hours/ Week (Total Notional Hours)		Credits	Assessment Scheme (Marks)					Total Marks
											CL		TL/LL		SL	
				CL	TL	LL	SL	NLH		Cr	SA	FA	SA	FA	SA	
1	MH101H	Basic Mathematics	DSC	4	2	-	2	8	(120)	4	70	30	-	25	25	150
2	CH101H	Applied Chemistry	DSC	4	-	2	2	8	(120)	4	70	30	25	25	25	175
3	AM101H	Engineering Mechanics	DSC	3	-	2	1	6	(90)	3	70	30	25	25	25	175
4	EN101H	Communication Skills	AEC	2	-	2	2	6	(90)	3	70	30	25	25	25	175
5	CE151H	Civil Engineering Workshop Practice	SEC	-	-	4	-	4	(60)	2	-	-	50	50	-	100
6	CM151H	Basics of Computer	SEC	-	-	2	2	4	(60)	2	-	-	25	25	25	75
7	VE151H	Integrated Personality Development	VEC	-	-	2	2	4	(60)	2	-	-	25	25	25	75
			Total	**13**	**2**	**14**	**11**	**40**	**(600)**	**20**	**280**	**120**	**175**	**200**	**150**	**925**

Abbreviations:
CL= Classroom Learning, TL= Tutorial Learning, LL= Laboratory Learning, SL=Self-Study Learning, NLH=Notional Learning Hours SA=Summative Assessment (At the End of Semester), FA=Formative Assessment (At the end of Unit(s) / Each LL/TL Activity) Classroom Learning FA= Average (CL_FA1,CL_FA2), Laboratory/Tutorial Learning FA= Average (LL_FA1, LL_FAn)
40% Combined passing for Classroom Learning (FA+SA), 40% individual passing for other Heads.
Symbols: ** Classroom Learning Summative Assessment usimg Objective Type Online Examination, + Laboratory Learning Summative Assessment by External Examiner.

(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
Civil Engineering

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Diploma in Civil Engineering

NEP 2020 Align Curriculum 2023 Program Structure

Semester: Second

SN	Course Code	Course Title	Course Category	Learning Scheme (Hours/Week)				Notional Hours/ Week (Total Notional Hours)		Credits	Assessment Scheme (Marks)					Total Marks
											CL		TL/LL		SL	
				CL	TL	LL	SL	NLH		Cr	SA	FA	SA	FA	SA	
1	MH102H	Applied Mathematics	DSC	4	2	-	2	8	(120)	4	70	30	-	25	25	150
2	PH101H	Applied Physics	DSC	4	-	2	2	8	(120)	4	70	30	25	25	25	175
3	CE101H	Construction Materials	DSC	3	-	-	1	4	(60)	2	70 **	30	-	-	25	125
4	CE102H	Building Construction	DSC	3	-	2	1	6	(90)	3	70	30	25	25	25	175
5	EN151H	Business Communication	AEC	2	-	2	-	4	(60)	2	-	-	25	25	-	50
6	ME152H	Engineering Graphics (Civil)	SEC	2	-	4	-	6	(90)	3	-	-	50	50	-	100
7	VE152H	Advanced Personality Development	VEC	-	-	2	2	4	(60)	2	-	-	25	25	25	75
			Total	**18**	**2**	**12**	**8**	**40**	**(600)**	**20**	**280**	**120**	**150**	**25**	**125**	**850**

Exit Course for "Certificate in Vocation"

8	IN151H	Internship (Basic Skills)	INP	-	-	-	8	8	(120)	4	-	-	-	-	50	50
			Total	**18**	**2**	**12**	**16**	**48**	**(720)**	**24**	**280**	**120**	**150**	**25**	**175**	**900**

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(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Secretary PBOS
Civil Engineering

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NEP 2020 Align Curriculum 2023 Program Structure

Semester: Third

SN	Course Code	Course Title	Course Category	Learning Scheme (Hours/Week)				Notional Hours/ Week (Total Notional Hours)		Credits	Assessment Scheme (Marks)					Total Marks
											CL		TL/LL		SL	
				CL	TL	LL	SL	NLH		Cr	SA	FA	SA	FA	SA	
1	AM201H	Mechanics of Structures	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
2	AM202H	Concrete Technology	DSC	3	-	2	1	6	(90)	3	70	30	25	25	25	175
3	CE201H	Surveying	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
4	CE202H	Highway Engineering	DSC	2	-	2	-	4	(60)	2	70	30	25 +	25	-	150
5	CE251H	Building Drawing with CAD	SEC	2	-	4	-	6	(90)	3	-	-	50 +	50	-	100
6	##291H	Generic Elective	GE	2	-	2	-	4	(60)	2	70 **	30	25	25	-	150
7	VE252H	Yog & Meditation	VEC	-	-	2	2	4	(60)	2	-	-	25	25	25	75
8	IN251H	Basic Internship	INP	-	-	2	6	8	(120)	4	-	-	-	-	50	50
			Total	**15**	**0**	**18**	**11**	**44**	**(660)**	**22**	**350**	**150**	**200**	**200**	**150**	**1050**

Abbreviations:
CL= Classroom Learning, TL= Tutorial Learning, LL= Laboratory Learning, SL=Self-Study Learning, NLH=Notional Learning Hours SA=Summative Assessment (At the End of Semester), FA=Formative Assessment (At the end of Unit(s) / Each LL/TL Activity) Classroom Learning FA= Average (CL_FA1,CL_FA2), Laboratory/Tutorial Learning FA= Average (LL_FA1, LL_FAn)
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(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
Civil Engineering

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NEP 2020 Align Curriculum 2023 Program Structure

Semester: Third

List of Generic Elective Courses MDM (Multidisciplinary Minor)

SN	Course Code	Course Title
1	ME291H	Elements of Mechanical Engineering
2	EE291H	Electrical Generation, Transmission and Distribution
3	EC291H	Analog and Digital Electronics
4	IT291H	Applied Multimedia Techniques
5	MT291H	Foundry Technology
6	TX291H	General Textile Technology
7	AE291H	Basics of Automobile
8	PK291H	Basics of Packaging Technology
9	CM291H	Open-Source Technologies
10	MK291H	Basic Mechatronics
11	AI291H	Python Programming
12	TR291H	Agro & Rural Tourism
13	NP291H	Any one NPTEL Course of more than 8 week duration

(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
Civil Engineering

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NEP 2020 Align Curriculum 2023 Program Structure

Semester: Fourth

SN	Course Code	Course Title	Course Category	Learning Scheme (Hours/Week)				Notional Hours/ Week (Total Notional Hours)		Credits	Assessment Scheme (Marks)					Total Marks
											CL		TL/LL		SL	
				CL	TL	LL	SL	NLH		Cr	SA	FA	SA	FA	SA	
1	AM203H	Geotechnical Engineering	DSC	4	-	2	2	8	(120)	4	70	30	25 +	25	25	175
2	AM204H	Theory of Structures	DSC	4	-	-	2	6	(90)	3	70	30	-	-	25	125
3	CE203H	Maintenance and Repairs of Structure	DSC	4	-	2	2	8	(120)	4	70	30	25 +	25	25	175
4	CEXXXH	Discipline Specific Elective	DSE	3	-	2	1	6	(90)	3	70	30	25	25	25	175
5	CE252H	Advanced Surveying	SEC	4	-	4	-	8	(120)	4	-	-	50 +	50	-	100
6	##292H	Generic Elective	GE	2	-	2	-	4	(60)	2	70 **	30	25	25	-	150
7	VE251H	Environmental Sustainability	VEC	-	-	2	2	4	(60)	2	-	-	25	25	25	75
			Total	**21**	**0**	**14**	**9**	**44**	**(660)**	**22**	**350**	**150**	**175**	**175**	**125**	**975**

List of Discipline Specific Elective

1	CE204H	Railway Engineering
2	CE205H	Traffic Engineering

Exit Course for "Diploma in Vocation"

8	IN252H	Internship (Vocational Skills)	INP	-	-	-	8	8	**(120)**	4	-	-	-	-	50	50
			Total	**21**	**0**	**14**	**17**	**52**	**(780)**	**26**	**350**	**150**	**175**	**175**	**175**	**1025**

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(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
Civil Engineering

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NEP 2020 Align Curriculum 2023 Program Structure

Semester: Fourth

List of Generic Elective Courses MDM (Multidisciplinary Minor)

SN	Course Code	Course Title
1	ME292H	Workshop Technology
2	EE292H	Electrical Machines
3	EC292H	Principles of Communication Engineering
4	IT292H	Web Designing
5	MT292H	Testing of Materials
6	TX292H	Dyeing and Printing
7	AE292H	Two-Wheeler Technology
8	PK292H	Folding Carton & Corrugated Box Manufacturing
9	CM292H	Web Development
10	MK292H	Computer Aided Design
11	AI292H	Basics of Artificial Intelligence
12	TR292H	Wildlife Tourist Guide/ Naturalist
13	NP292H	Any one NPTEL Course of more than 8 week duration

(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
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NEP 2020 Align Curriculum 2023 Program Structure

Semester: Fifth

SN	Course Code	Course Title	Course Category	Learning Scheme (Hours/Week)				Notional Hours/ Week (Total Notional Hours)		Credits	Assessment Scheme (Marks)					Total Marks
											CL		TL/LL		SL	
				CL	TL	LL	SL	NLH		Cr	SA	FA	SA	FA	SA	
1	AM301H	Design of Structures	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
2	CE301H	Hydraulics	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
3	CEXXXH	Discipline Specific Elective	DSE	3	-	2	1	6	(90)	3	70	30	25	25	25	175
4	CE351H	Estimating and Costing	SEC	2	-	4	-	6	(90)	3	-	-	50 +	50	-	100
5	##391H	Generic Elective	GE	2	-	2	-	4	(60)	2	70 **	30	25	25	-	150
6	IN301H	Industrial Management	INP	2	-	-	-	2	(30)	1	70 **	30	-	-	-	100
7	VE351H	Indian Constitution	VEC	-	-	2	-	2	(30)	1	-	-	25	25	-	50
8	IN351H	Internship (Seminar)	INP	-	-	2	10	12	(180)	6	-	-	25	-	50	75
			Total	**15**	**0**	**16**	**13**	**44**	**(660)**	**22**	**350**	**150**	**200**	**175**	**125**	**1000**

List of Discipline Specific Elective

1	CE302H	Solid Waste Management
2	CE303H	Advanced Building Services

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40% Combined passing for Classroom Learning (FA+SA), 40% individual passing for other Heads.
Symbols: ****** Classroom Learning Summative Assessment usimg Objective Type Online Examination, **+** Laboratory Learning Summative Assessment by External Examiner.

(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
Civil Engineering

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Diploma in Civil Engineering

NEP 2020 Align Curriculum 2023 Program Structure

Semester: Fifth

List of Generic Elective Courses MDM (Multidisciplinary Minor)

SN	Course Code	Course Title
1	ME391H	Heat Engine Technology
2	EE391H	Electrical Wiring and Estimation
3	EC391H	Microcontroller and Applications
4	IT391H	Cyber Security and Privacy
5	MT391H	Heat Treatment
6	TX391H	Garment and fashion Technology
7	AE391H	Four-Wheeler Technology
8	PK391H	Injection & Extrusion Blow Molding in Packaging
9	CM391H	Digital Marketing
10	MK391H	Automotive Mechatronics
11	AI391H	Machine Learning
12	TR391H	Tourism Resources of India
13	NP391H	Any one NPTEL Course of more than 8 week duration

(Dr. D.K.Parbat)
HOD & Chairman PBOS
Civil Engineering

(Dr. G. V. Gotmare)
Member Sectretary PBOS
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Government Polytechnic, Nagpur

Diploma in Civil Engineering

NEP 2020 Align Curriculum 2023 Program Structure

Semester: Sixth

SN	Course Code	Course Title	Course Category	Learning Scheme (Hours/Week)				Notional Hours/ Week (Total Notional Hours)		Credits	Assessment Scheme (Marks)					Total Marks
											CL		TL/LL		SL	
				CL	TL	LL	SL	NLH		Cr	SA	FA	SA	FA	SA	
1	CE304H	Water Resources Engineering	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
2	CE305H	Environmental Engineering	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
3	CE306H	Contracts and Accounts	DSC	3	-	2	1	6	(90)	3	70	30	25 +	25	25	175
4	AMXXXH	Discipline Specific Elective	DSE	3	-	2	1	6	(90)	3	70	30	25	25	25	175
5	CE352H	Capstone Project	SEC	-	-	4	-	4	(60)	2	-	-	50 +	50	-	100
6	IN352H	Internship (Report Writing)	INP	-	-	2	10	12	(180)	6	-	-	25	-	50	75
7	VE352H	Indian Knowledge System	VEC	-	-	2	-	2	(30)	1	-	-	25	25	-	50
8	IN353H	Entrepreneurship & Startup	INP	1	-	-	1	2	(30)	1	-	-	-	-	75	75
			Total	**13**	**0**	**16**	**15**	**44**	**(660)**	**22**	**280**	**120**	**200**	**175**	**225**	**1000**

List of Discipline Specific Elective

1	AM302H	Advanced Concrete Technology
2	AM303H	Advanced Design Of Structures

Abbreviations:
CL= Classroom Learning, TL= Tutorial Learning, LL= Laboratory Learning, SL=Self-Study Learning, NLH=Notional Learning Hours SA=Summative Assessment (At the End of Semester), FA=Formative Assessment (At the end of Unit(s) / Each LL/TL Activity) Classroom Learning FA= Average (CL_FA1,CL_FA2), Laboratory/Tutorial Learning FA= Average (LL_FA1, LL_FAn)
40% Combined passing for Classroom Learning (FA+SA), 40% individual passing for other Heads.
Symbols: ****** Classroom Learning Summative Assessment usimg Objective Type Online Examination, **+** Laboratory Learning Summative Assessment by External Examiner.

(Dr. D.K.Parbat)
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Civil Engineering

(Dr. G. V. Gotmare)
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Semester

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AI/PK/MT/MK/TX
Course Category	:	DSC
Course Code	:	MH101H
Course Title	:	Basic Mathematics

I Rationale:

Mathematics is the core course and plays a crucial role in diploma programme. This Basic course of mathematics is a foundations of Engineering which will help in developing compitency, logical thinking, enhance qualitative literacy analytical thinking which are valuable for lifelong learning and professional growth. Also Basic course of mathematics is being develop the requisite course outcomes in most of the engineering programme and thereby enhance employability. It will help to apply the principles of basic mathematics to solve related technological problems. Hence the course provides the insight to analyse engineering problems scientifically using logarithm, partial fraction, determinant, matrices, trigonometry and statistics.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the concept of Mathematics to solve industry-based technological problems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** Algebra, Laws of Logarithm, and change of base of logarithm to solve engineering problems.

CO2: **Resolve** proper fraction improper fraction into partial fraction.

CO3: **Apply** matrix method to solve simultaneous equation of Two and three variables in engineering problems.

CO4: **Use** concept of Allied Angles, Compound angles, Multiple and sub-multiples Angles to solve engineering problems.

CO5: **Use** the principle values of inverse trigonometric function, properties to solve the examples of inverse Trigonometric function.

CO6: **Use** the measures of central tendencies and measures of dispersion in decision making.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	2	-	2	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	-	-	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Logarithm	1a	Evaluate the value of given Logarithm without using calculator.	1.1	Logarithm:-Concept of Logarithm	CO1
	1b	Solve the given logarithm by Using Laws of Logarithm.	1.2	Rules And Laws of Logarithm; Addition, Subtraction, Multiplication, Division And Change of Base Formula.	
	1c	Identify natural and common Logarithm.	1.3	Concept of natural & common Logarithm.	
UNIT II: Partial Fraction	2a	Identify the given rational fraction is proper or improper fraction.	2.1	Concept of rational fraction, proper, improper fraction and partial fraction.	CO2
	2b	Resolve the given proper fraction into partial fraction.	2.2	Resolving proper fraction into partial fraction. Denominator containing non- repeated linear factors, Denominator containing repeated linear factors, Denominator containing irreducible non repeated quadratic factors	
	2c	Resolve the given improper Fraction into partial fraction.	2.3	Resolving improper fraction into partial fraction.	

UNIT III: Determinant & Matrix	3a	Find the value of given determinant of order 2 and 3.	3.1	Concept of determinant ,order of determinant, Expansion& Evaluation of determinant of order 2 and 3.	CO3
	3b	Find inverse of given matrix.	3.2	Concept of matrix, Types of matrices, Algebra of matrices Transpose of matrix , ad-joint, singularity of matrix and inverse of matrix	
	3c	Solve the given simultaneous equation in two and three variables.	3.3	Solution of system of linear equations two and three variables by inverse matrix method	
UNIT IV: Trigonometry	4a	Use fundamental identities to solve the given Trigonometric relation.	4.1	Fundamental identities, Trigonometric ratios of any angle.	CO4
	4b	Apply the concept of allied angle , compound angle, multiple angle (2θand 3θ) sub-multiple angle (θ/2),to solve the given trigonometric relation	4.2	Trigonometric ratios of allied angles, compound angles, multiple and sub-multiple angles (without proof)	
	4c	Apply Factorization, De-Factorization formulae to solve the given trigonometric relations.	4.3	Factorization and de-factorization formulae (without proof).	
UNIT V: Inverse Trigonometric Function	5a	Find the principle value the given Inverse trigonometric functions.	5.1	Concept of inverse trigonometric functions, Principle values of inverse Trigonometric functions.	CO5
	5b	Solve the given inverse	5.2	Properties of inverse Trigonometric functions.	
	5c	Evaluate the value of given Inverse-trigonometric functions.	5.3	Relation between inverse trigonometric functions	
	6a	Find mean or Combined Mean of given Statistical data.	6.1	Measures of central tendency Mean (only), & Combined mean.	

UNIT VI: Statistics	6b	Find the Range, Co-efficient of Range, Mean Deviation, Standard Deviation of given Statistical data.	6.2	Measures of dispersion:- Range , mean deviation , standard deviation of Discrete, Grouped & Ungrouped Data.	CO6
	6c	Find variances, co-efficient of variation of given Statistical data.	6.3	Variance and coefficient of variation, of Discrete, Grouped & Ungrouped Data.	
	6d	Check the Consistency & Reliability of given sets of data.	6.4	Comparison of two sets of observations, Consistency & Reliability.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Evaluate the value of given logarithm without using calculator	2#	CO1
I	2	Solve simple problems of Logarithm based on laws of logarithm, change base Formulas. Identify the given logarithm is Common Logarithm Or Natural Logarithm.	2#	CO1
II	3	Identify the given Rational Fraction is proper fraction or improper fraction. Resolve improper fraction into Partial fraction.	2#	CO2
II	4	Resolve into partial fraction using linear non-repeated, repeated, and irreducible quadratic factors.	2#	CO2
III	5	Evaluate the given Determinant of order 2 and 3 by expansion method.	2#	CO3
III	6	Solve elementary problems on Algebra of matrix for branch specific related with engineering application.	2#	CO3
III	7	Verify the given properties of transpose of matrix.	2#	CO3
III	8	Find adjoint of matrix and inverse of matrix.	2#	CO3
III	9	Solve the given simultaneous equation of order 2 and 3.	2#	CO3
IV	10	Verify the given trigonometric Identities, Relations by using Trigonometric Ratios.	2#	CO4
IV	11	Verify the given trigonometric Identities, Relations by using allied angle and compound angle formulas.	2#	CO4
IV	12	Verify the given trigonometric Identities, Relations by using multiples angle and sub-multiples angle formulas.	2#	CO4
IV	13	Verify the given trigonometric Relations by using factorization and De-factorization formulas.	2#	CO4
V	14	Find the principle values of inverse trigonometric function.	2#	CO5
V	15	Verify the given inverse trigonometric Relations by using properties of inverse trigonometric function.	2#	CO5
VI	16	Find the mean of any given data, and find the combined mean given two sets of data.	2#	CO6

VI	17	Find the range, co-efficient of range of the given grouped and un-grouped data.	2#	CO6
VI	18	Calculate the mean, standard deviation of grouped and un-grouped data related to the engineering problems.	2#	CO6
VI	19	Calculate the variance, co-efficient of variances grouped and un-grouped data related to the engineering problems.	2#	CO6
VI	20	Justify the consistency and Reliability of two given sets.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Verify the complicated calculation by logarithm and calculator.
2. Prepare a chart of Rules, Laws of Logarithm.
3. Convert the given improper fraction into proper fraction and resolve into partial fraction.
4. Solve simultaneous equation in two variables by matrix inversion method and write mathematical programming related with engineering field.
5. Prepare the list of Trigonometric formulas and inverse trigonometric formulas.
6. Represent trigonometric ratios, logarithmic function graphically and interpret the Result.
7. Collect the data from market, class test marks in your class or from two groups then find the mean.
8. Compare the any two cricket players by using consistency and reliability.
9. Calculate mean Deviation, standard deviation, co-efficient of variance of any given data.
10. Find the number of unknown variables in two groups if the combined mean is given.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Logarithm	5	C	02	04	00	6
			O	00	00	04	4
2	Partial Fraction	8	C	02	04	04	10
			O	00	00	06	6
3	Determinant & Matrix	14	C	02	04	10	16
			O	00	04	04	8
4	Trigonometry	14	C	02	04	12	18
			O	02	04	04	10
5	Inverse Trigonometric Function	5	C	02	04	00	6
			O	00	04	00	4
6	Statistics	14	C	02	00	12	14
			O	00	04	04	8
Total		60	C	12	20	38	70
			O	2	16	22	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	4R2	5R2	6R2	5	7
2	1U4	1A4	2U4	2A4	3U4			3	5
3	3U4	3A4	3A4	4U4	6U4			3	5
4	4U4	4A4	5U4	5U4	6A4			3	5
5	2A6	4A6	6A6					2	3
6	3A6	4A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Attendance (Regularity And Awareness About Performing Assignment)	5
2	Assignment Contents (20-25 examples is compulsory on each unit)	10
3	Completion of Assignment, Neatness And cleanliness of maintaining Assignment Copy.	10
4		
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Interest And Awareness About Performing Assignment	5
2	Assignment Contents	10
3	Completion of Assignment, Neatness And cleanliness of maintaining Assignment Copy.	10
4		
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	2	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	1	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Higher Algebra	Hall & Knight, Publisher: Arihant, 6thEdition 2021	9789351762539
2	Plane Trigonometry	S.L. Loney, Publisher: Arihant, 5thEdition 2015	9352030540
3	Basic Statistics	B.L. Agarwal, Publisher: Anshan	1848290675
4	Basic Mathematics	G. V. Kumbhojkar,P. Jamnadas LLP.,21st Edition 2017	978-81-934573-5-1
5	Fundamental of Statistics	S.C.Gupta, Himalaya Publishing House, 7th Edition 2015	9789350517697
6	Higher Engineering Mathematics	Khanna Publication New Delhi, B.S.Grewal	8174091955

XV e-References:

1. https://econtent.msbte.ac.in/econtent/econtent_home.php assessed on 20th August 2023
2. https://www.khanacademy.org assessed on 20th August 2023
3. https://www.youtube.com/watch?v=5_TuK1yCPD4 assessed on 20th August 2023
4. http://nptl.ac.in/course/106102064 (online Learning Initiatives By IITs and IISc) assessed on 20th August 2023
5. https://www.khannacademy.org/mathq gelid=CnqHuabCys4CFdOJaddHoPig assessed on 20th August 2023

XVI List of Major Equipment/Machineries with Specification:

1. Nil
2. --
3. --

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. P.T. Khobaragade	I/C Mathematics Dept.	Govt. Polytechnic Nagpur
2	Mr. S.M. Sayyed	Ex-Lecturer	Govt. Polytechnic Nagpur
3	Mr. G.R. Dewalkar	Lecturer	Govt. Polytechnic Sakoli
4	Dr. P. B. Bahatkar	Professor	Y. C. C. E. Nagpur
5	Mr. V.M.Meshram	Ex-Lecturer	Govt. Polytechnic Nagpur

(Mr. P.T. Khobaragade)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Secretary PBOS, COMMON

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GOVERNMENT POLYTECHNIC, NAGPUR
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COURSE CURRICULUM

Program	:	DIPLOMA IN ME/AE/CE/EE/EC/PK/MT/TX/IT/CM/AIML/MK
Course Category	:	DSC
Course Code	:	CH101H
Course Title	:	Applied Chemistry

I Rationale:

Chemistry is the basic science which is essential to all engineering courses. For an engineer, the usage of equipment's and instruments would require knowledge of chemical substances, their composition and properties. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to all engineering fields. Chemistry subject knowledge also aims to bridge the theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in the field of engineering. This will be gateway for development of reasoning capacity of students and understanding new technology as well.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply principles of chemistry to solve broad based relevant engineering problems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Analyse** the Bonding-type in a compounds and application of catalyst in industries.

CO2: **Select** metal and nonmetal materials for industrial applications.

CO3: **Analyse** engineering materials on the basis of properties and applications.

CO4: **Apply** the concept of Electrochemistry to solve engineering and industrial problems.

CO5: **Solve** metal-corrosion problems using relevant preventive methods.

CO6: **Analyse** different type of energy sources for sustainable development.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	-	2	2	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Chemical Bonding and Catalysis	1a	Classify valence electrons and type of bond in given compounds.	1.1	Indian Chemistry: Philosophy of atom by Acharya Kanad. Valency: Octet Rule, Duplet Rule, Definition & types of valences (Electrovalence & Covalence), types of bond electrovalent, Covalent, Co-ordinate)	CO1
	1b	Formulate given molecule on the basis of given type.	1.2	Formation of Electrovalent e.g., NaCl, $CaCl_2$, MgO, Formation of Electrovalent e.g., NaCl, $CaCl_2$, MgO, Formation of Covalent Compounds CO_2, NH_3, N_2 Formation of coordinate compound e.g. (NH_4^+), (H_3O^+)	
	1c	Differentiate between Electrovalent and Covalent compound on basis of given properties.	1.3	Distinction between Electrovalent & Covalent compounds (Properties-Formation, Melting point, Boiling point, Type of bond, Solubility, Strength of bond).	

UN	1d	Select the relevant catalyst-type for given application.	1.4	Catalysis: Definitions of Catalyst, Types of Catalyst, Positive Catalyst, Negative Catalyst, Auto-catalyst, Definitions of catalysis, Types of catalysis (Homogeneous, Heterogeneous) Industrial Applications of Catalyst.	
UNIT II: Metallurgy, Alloy and Polymer	2a	Draw the flow chart of metal extraction process with given terms in metallurgy.	2.1	Metallurgy: Definitions of terms used in metallurgy - Minerals, Ore, Gangue, Flux, Slag. Definition of metallurgy, flow chart of Metal extraction process (Crushing, Concentration (physical and chemical), reduction, Refining.	CO2
	2b	Select proper alloy for given application or vice versa.	2.2	Definition of alloy, purposes of alloy formation, Types of alloys (Ferrous alloy and Nonferrous alloy) Composition properties and application of High-speed steel, Magnetic steel, Duralumin, Woods metal.	
	2c	Distinguish between Thermosoftening and Thermosetting plastics on given points.	2.3	Polymer (Plastic): Definition o fpolymer, types opolymer and difference of Thermosoftening and Thermosetting plastics (Properties-Formation, Structure, Molecular weight, Heating effect, Reclaiming, Chemical bonding, Nature, Solubility).	
	2d	Select the given Plastic Polymer for Industry application.	2.4	Formation of Plastic by Addition polymerization of Polyethylene, Polystyrene. Formation of Plastic by Condensation process of Bakelite plastic, Nylon (6, 6).	
	2e	Use given Thermal insulators in industry on their characteristics.	2.5	Insulating material: Characteristics of Thermal insulators. Preparation, Properties & Applications of Thermocol & Glass wool.	

UNIT III: Engineering Materials	3a	Illustrate functions & characteristics of given Lubricants, for different types of machines.	3.1	Lubricants : Definition, Types of Lubricants, Functions of Lubricants. Characteristics of Lubricants- Viscosity, Viscosity Index ,Volatility,Oiliness, Cloud and Pour point, lash and Fire point, Acid value. Selection of Lubricant for various types of machines such as I.C engine, Gear system, Cutting tools, Delicate and Sewing machines, Tractors and Rollers.	CO3
	3b	Detect the adverse effects of hard water as per given industry.	3.2	Water: Types of impurities in natural water. Definitions of hard and soft water, types of hardness, Unit of ardness (ppm) Adverse effects of hard water in Industries-Paper industry, Textile industry, Dyeing industry, Sugar industry.	
	3c	Select relevant water treatment process for removal of given impurities.	3.3	Potable water treatment: Sedimentation , Coagulation, Filtration, Sterilization (Chlorination method).	
	3d	Relate given properties and applications of Cement and Lime as a construction material.	3.4	Cement & Lime: Portland cement: Definition, chemical composition. Special Cements: Properties and Application of Water proofing cement, Super sulphate cement. Lime: Composition, Properties and Uses of Fat lime, Lean lime.	
d Batteries	4a	Interpret the given terms involved in Electrochemistry.	4.1	Basic concepts of electrolysis: Atoms, Ions, Electrolyte, conductivity of electrolytes, type of electrolyte- strong and weak electrolyte. Ionization and electrolytic dissociation, Arrhenius theory of electrolytic dissociation, degree of ionization, factors affecting degree of ionization.	

UNIT IV: Electrochemistry,cells anc	4b	Solve engineering problems using Faraday's law of electrolysis.	4.2	Electrolysis : Faraday's laws of electrolysis: Faraday's First and Second law (Statement and mathematical expression, numericals) Application of electrolysis: Electroplating Silver.	CO4
	4c	Calculate the pH/pOH of solutions with given concentration.	4.3	pH and pOH: Definition of pH, pOH, pH scale, numerical.	
	4d	Use of given cells and batteries in Engineering field.	4.4	Electrochemical cells/ batteries: Basic concepts: cell, attery, distinction between Primary cell (e.g. Dry cell) and secondary cells (e.g. Ni-Cd cell) Fuel cell: Definition, construction, working, advantages, limitations and applications of Hydrogen-oxygen fuel cell.	
UNIT V: Corrosion	5a	Identify the given types of oxide film & its effect on corrosion.	5.1	Definition of corrosion, Types of corrosion, mechanism of Atmospheric corrosion. Effect of oxide film on atmospheric corrosion. Factor effecting atmospheric corrosion.	CO5
	5b	Analyse mechanism of given type of corrosion.	5.2	Immersed Corrosion or Electrochemical Corrosion, definition, types and mechanism (Hydrogen evolution and oxygen absorption).	
	5c	Select different corrosion protection methods and its use in given situation.	5.3	Application of Protective Coatings like metallic coating by - Galvanizing, Tinning, Sherardizing, Metal Spraying, Metal Cladding. Non-metallic coating: Paint - Characteristics, constituents of Paint and their functions.	
trol	6a	Compare types of Fuel on given points.	6.1	Energy: Definitions of a fuel, Classification of fuels with suitable examples, Characteristics of a good fuel, Calorific value and Ignition temperature, Comparison between Solid, Liquid, Gaseous fuels based on their properties.	

UNIT VI: Energy and Pollution Con	6b	Analyse components of fuel by proximate analysis.	6.2	Classifications of fuel: Solid fuels: analysis of solid fuels- Proximate analysis for determination of moisture, volatile matter, ash and fixed carbon, significance of Proximate analysis.	CO6
	6c	Describe the properties and uses of given solid, liquid and gaseous fuel.	6.3	Liquid fuels: Bio diesel - properties, applications. Gaseous fuels: Composition, properties, applications of LPG, CNG.	
	6d	Select proper pollution control methods for sustainable development.	6.4	Pollution control: Definition of pollution – Types of pollution (Air, water pollution) 3R Concept, recycling of plastic. E waste management, sustainable development– significance of Wind Energy, Solar Energy.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Explore the chemistry laboratory.	2#	CO1
I	2	Analyse basic and Acidic Radicals of known salt solution-1 (Confirmatory Test) using qualitative analysis method for compound composition.	2#	CO1
I	3	Analyse basic and Acidic Radicals of known salt solution-2 (Confirmatory Test) using qualitative analysis method for compound composition.	2#	CO1
I	4	Analyse basic and Acidic Radicals of known salt solution-3 (Confirmatory Test) using qualitative analysis method for compound composition.	2#	CO1
II	5	Find the quality of alloy by determining the percentage of Iron in given steel sample by Redox titration.	2	CO2
II	6	Prepare Phenol formaldehyde resin used in manufacturing of Bakelite Plastic, for Polymer industries.	2#	CO2
III	7	Analyse Total hardness (permanent and temporary) of given sample of water by EDTA method, for various industries.	2#	CO3
III	8	Calculate the percentage of calcium content in cement, for different constructional purposes.	2#	CO3
III	9	Estimate the acid value of lubricant by KOH, for various machines. OR Find out the quality of lubricant, by calculating coefficient of viscosity using Ostwald's Viscometer.	2	CO3
IV	10	Detect the nature of given solution by finding its pH value by using pH meters.	2#	CO4
IV	11	Find the Electrochemical equivalent (ECE) of copper,for cell manufacturing industries.	2#	CO4
V	12	Compare the rate of corrosion (Al-strip) with respect to given media for prevention of metal corrosion.	2#	CO5
V	13	Calculate the strength of given Hydrochloric acid solution by titrating it against sodium hydroxide solution to control rate of corrosion.	2#	CO5

VI	14	Categorize the given paint samples by finding thinner content in it, for various Paint industries.	2#	CO6
VI	15	Estimate the percentage of moisture and ash content in the given coal sample by proximate analysis, for power generation.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect information by library survey regarding biography/ valuable contribution in Chemistry of any one Indian Chemist.
2. Construct a model of any one ionic /covalent/co-ordinate compounds.
3. Compare the role of given types of catalysts (positive/negative/auto) in different chemical reactions.
4. Categorize given types of alloy by collecting various metal alloy samples.
5. Construct a model of Concentration/reduction/refining process in metal extraction.
6. Collect information by library survey regarding engineering material used in various industries.
7. Analyse different samples of Cement/Lime/Water/Lubricants according to given properties.
8. Compare different chlorinating agent of Sterilization of potable water at domestic level.
9. Categorize various types of Cells by market survey method.
10. Collect various types of corroded metal sample.
11. Compare rate of corrosion process between ferrous and aluminium metals.
12. Prepare a chart construction of Hydrogen-Oxygen Fuel Cell.
13. Compare the type of fuels according to given properties.
14. Prepare a method of recycling of plastic, to sustain environment.
15. Analyse the PUC report (gas analyser method) of vehicle, to sustain environment.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Chemical Bonding and Catalysis	8	C	02	04	04	10
			O	00	04	00	4
2	Metallurgy, Alloy and Polymer	9	C	02	04	06	12
			O	00	08	00	8
3	Engineering Materials	12	C	02	08	04	14
			O	02	00	06	8
4	Electrochemistry,cells and Batteries	12	C	02	04	06	12
			O	00	06	04	10
5	Corrosion	9	C	00	04	06	10
			O	02	00	04	6
6	Energy and Pollution Control	10	C	02	04	06	12
			O	00	00	04	4
Total		60	C	10	28	32	70
			O	04	18	18	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	6R2	5R2	3R2	5	7
2	1U4	1A4	2U4	1U4	2U4			3	5
3	3U4	3U4	3A4	2U4	4A4			3	5
4	4U4	5U4	6U4	5A4	6A4			3	5
5	2A6	4A6	3A6					2	3
6	5A6	6A6	4U6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Method, Selection of Chemicals/Equipments	5
2	Performance + Calculation	10
3	Result, Conclusion	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Ideas and content	5
2	Practical utility in present scenario	10
3	Scientific approach	5
4	Conclusion	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	3	-	-
CO2	3	-	-	2	-	-	3	-	-
CO3	3	-	-	2	-	-	3	-	-
CO4	3	2	-	2	-	-	3	-	-
CO5	3	2	-	-	-	-	3	-	-
CO6	3	2	-	-	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Engineering Chemistry	R. Sivakumar N. Sivakumar and Tata McGraw Hill, edition 10.	9780745- 328896
2	Engineering Chemistry	Jain and Jain , Dhanpat Rai publishing company(P) ltd.15 edition	10092
3	Fundamental of Electrochemistry	Bagotsky V.S. National Council of Education Research and Training, New Delhi, 2013	8174506314
4	Industrial chemistry	Goel Publication, edition-8	81877224002
5	Applied Chemistry with Lab Manual	Anju Rawlley, Devdatta V. Saraf , Khanna Book Publishing Co.(P) Ltd. New Delhi, 2021	978-93-91505-44-8

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1. https://wwws.ancient-origins.net/history-famous-people/indian-sage-acharya-kanad-001399 , IKS Philosophy of atom by Acharya Kanad. assessed on 10th August 2023
2. http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_polymers- , assessed on 10 August 2023
3. http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_fluids- , assessed on 10 August 2023
4. http://www.ausetute.com.au/corrosion.html, assessed on 10 August 2023
5. http://www.sherardizing.com/resources/files/9_Sherardizing_Corrosion.pdf, assessed on 10 August 2023
6. http://www.galvanizeit.org/aga/animation , assessed on 10 August 2023
7. http://www.ehow.com/list_6725219_different-types-metal-cladding.html , assessed on 10 August 2023

XVI List of Major Equipment/Machineries with Specification:

1. Electronic balance (measure up to 0.001 mg)
2. Battery 12 volt
3. Digital multi-meter
4. Rheostat assorted sizes
5. Voltmeter MI 0-150-300 V
6. Ammeter MI 0-5-10 A
7. Electrolytic cell set up
8. Digital PH meter

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.M.S.Rathod	Lecturer in Chemistry	Government Polytechnic, Nagpur
2	Dr. C.P. Pandhurnekar	Asst.Prof. Deptt. Of Chemistry	Ramdeobaba Engg.college,Nagpur.
3	Dr.P.B.Sarode	Lecturer in Chemistry	Government Polytechnic, Khamgaon
4	Dr.D.B.Rana	Asst.Prof. Deptt. of Chemistry	S.B.Jain Engg. College, Nagpur
5	Dr S.L.Sayre	Lecturer in Chemistry	Government Polytechnic, Nagpur
6	Dr.P.B.Chouke	Lecturer in Chemistry	Government Polytechnic, Nagpur
7	Prof. D.H. Patil	Lecturer in Chemistry	Government Polytechnic, Nagpur

(Mr. P. T. Khobragade)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Secretary PBOS, COMMON

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/PK/MT/MK/TX
Course Category	:	DSC
Course Code	:	AM101H
Course Title	:	Engineering Mechanics

I Rationale:

Study of this course develops understanding of effect of force on a body. It helps in analytical and graphical solutions to problem related to forces acting on body. It also helps in understanding concept and application of Equilibrium, friction, centroid and centre of gravity. Study of simple machines gives idea about input, output, efficiency and friction of machine. Study of this course is very useful at higher level like strength of materials, Mechanics of Structure, Design of Structures etc.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the principles of engineering mechanics to solve engineering problems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** the relevant simple lifting machine for given purpose.

CO2: **Apply** various theorems to find the resultant of system of forces.

CO3: **Apply** law of equilibrium on different bodies.

CO4: **Locate** Centre of gravity and Centroid in various sections.

CO5: **Analyze** concept of friction in various conditions.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Simple lifting Machine	1a	Compare given machines on the basis of given points.	1.1	Concept of simple lifting machine, uses of machine, definition of load, effort, mechanical advantage, velocity ratio, efficiency of Machines, reversible and non-reversible machines.	CO1
	1b	Determine given terms of simple lifting machine.	1.2	Ideal machine, friction in machine, law of machine, maximum Mechanical advantage and efficiency.	
	1c	Determine velocity ratios, efficiency and law of various machines for given data.	1.3	Velocity ratios of Simple Axle and Wheel, Differential axle wheel, Single Purchase & Double purchase crab winch, Simple Screw Jack, Weston's Differential pulley block, Geared pulley block, Two Sheaves and Three Sheaves pulley block, Worm and Worm wheel.	
	2a	Classify given terms related to Engineering Mechanics.	2.1	Significance of engineering mechanics, necessity and Classification of engineering mechanics.	

UNIT II: Forces	2b	Classify the given units of scalar and vector quantity.	2.2	Definitions: Space, time, particle, body, rigid body, mass, weight, scalar and vector quantity. Units of measurement, Fundamental units and derived units.	CO2
	2c	Describe given terms related to force.	2.3	Concept of force, definition of force, unit of force, effects of force, Characteristics of force.	
	2d	Identify the given force system and effect of a force.	2.4	System of forces. Principle of transmissibility of force.	
	2e	Resolve and find resultant of force/force system.	2.5	Composition of forces & Resolution of forces (Two dimensional), Orthogonal and Non-Orthogonal components of a force. Resultant force. Resultant of concurrent, non-concurrent and parallel forces, Law of parallelogram of forces: limitations and its applications.	
	2f	Apply Varignon's theorem based on given data.	2.6	Definition of moment, sign convention of moments, types of moments. Law of moment, definition of couple, types of couple, properties of couple, Varignon's theorem of moment and its application.	
	2g	Calculate Resultant force on the basis of given data by graphical method.	2.7	Introduction to graphic statics, graphical representation of force, Bow's notation, Space diagram, force diagram, polar diagram & funicular polygon.	
librium	3a	Determine given term related to equilibrium unknown forces using given methods.	3.1	Equilibrium and Equilibrant. Free body and free body diagram. Analytical and graphical condition of equilibrium.	
	3b	Determine unknown force in the given situation using Lami's theorem.	3.2	Lami's Theorem: limitations and its application.	

UNIT III: Equi	3c	Describe given terms related to Beam, load and supports with examples.	3.3	Equilibrium of concurrent, non-concurrent and parallel forces. Beam, span, type of beams, type of supports, types of loading: point load and Uniformly Distributed Load.	CO3
	3d	Determine reactions in the given type of beam by given method.	3.4	Analytical and Graphical method to calculate reactions at support for point load and Uniformly Distributed Load on simply supported and overhanging beams.	
UNIT IV: Centroid & Centre of gravity	4a	Determine centroids of given plain regular figures.	4.1	Centroid and centre of gravity, difference between centroid and centre of gravity. Locating centroid of regular figures such as triangle, rectangle, circle, Semi circle, quarter circle. (Formula only)	CO4
	4b	Calculate centroid of the given compound plain lamina.	4.2	Centroid of compound figures, having combination of two different geometric areas only.	
	4c	Determine the centre of gravity of given solid bodies.	4.3	Centre of gravity of solid bodies like cuboid, cylinder, cone, sphere and hemisphere.	
	4d	Determine centre of gravity of given compound solids.	4.4	Centre of gravity of compound bodies having combination of only two different geometric shapes.	
UNIT V: Friction	5a	Calculate given terms related to friction.	5.1	Friction and its importance in engineering, types of friction, laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.	CO5
	5b	Determine the friction force in the given situation of frictional bodies.	5.2	Equilibrium of bodies on horizontal plane subjected to force parallel and inclined to the plane. Body resting on inclined plane subjected to force parallel to the plane. (Excluding ladder friction).	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Determine M.A., V.R., Efficiency of and law of machine for simple /Differential Axle and Wheel.	2#	CO1
I	2	Determine M.A., V.R., Efficiency and law of machine for Simple Screw Jack.	2#	CO1
I	3	Determine M.A., V.R., Efficiency and law of machine for Two Sheave Or three sheave Pulley Block.	2#	CO1
I	4	Determine M.A., V.R., Efficiency and law of machine for Single purchase Crab Or Double purchase Crab.	2	CO1
I	5	Determine M.A., V.R., Efficiency and law of machine for Worm and Worm Wheel.	2	CO1
II	6	Use Force table to determine resultant of concurrent force system using law of Polygon of forces.	2#	CO2
II	7	Determine Forces in the members of jib crane.	2#	CO2
II	8	Determine resultant of co-planer concurrent forces by graphical method. (Problem I)	2#	CO2
II	9	Determine resultant of co-planer concurrent forces by graphical method. (Problem II)	2#	CO2
II	10	Determine resultant of co-planer non-concurrent forces by graphical method. (Problem I)	2	CO2
II	11	Determine resultant of co-planer non-concurrent forces by graphical method. (Problem II)	2	CO2
III	12	Apply lamis theorem to determine unknown force.	2#	CO3
III	13	Determine support reactions for simply supported beam.	2#	CO3
III	14	Determine beam reactions for Vertical Point Load and UDL by Graphical method. (Problem I)	2	CO3
III	15	Determine beam reactions for Vertical Point Load and UDL by Graphical method. (Problem II)	2	CO3
IV	16	Locate the centroid of plane lamina by method of suspension.	2#	CO4
V	17	Determine co-efficient of Friction between different surfaces such as Wood and wood, Wood and glass, Wood and metal.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect five different photographs indicating concurrent, parallel, general force system in equilibrium.
2. Prepare table showing type of machine and related industrial application.
3. Collect five different situations where Law of moments plays important role.
4. Prepare models representing different types of supports.
5. Illustrate situations wherein friction is essential and not essential.
6. Prepare models in the form of geometrical figures and solids and locate centroid and center of gravity of them.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Simple lifting Machine	7	C	02	04	04	10
			O	00	04	04	8
2	Forces	12	C	02	08	06	16
			O	02	04	04	10
3	Equilibrium	10	C	02	04	10	16
			O	02	04	06	12
4	Centroid & Centre of gravity	6	C	02	04	06	12
			O	00	04	00	4
5	Friction	10	C	02	04	10	16
			O	00	00	06	6
6			C				
			O				
Total		45	C	10	24	36	70
			O	4	16	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	5R2	2R2	3R2	5	7
2	1U4	2U4	2U4	1U4	2U4			3	5
3	3U4	4U4	5U4	3U4	4U4			3	5
4	1A4	3A4	5A4	1A4	2A4			3	5
5	2A6	3A6	3A6					2	3
6	4A6	5A6	5A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Drawing diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	2	-	-
CO5	3	2	-	2	1	-	2	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Applied Mechanics	R.S. Khurmi, S. Chand & Co. New Delhi, 2014	10:8121916437 13:9788121916431
2	Engineering Mechanics	Sunil Deo, Label Book Publishers New Delhi, 2014	10:9381595550 13:978-938159558
3	Engineering Mechanics	Basu, Tata Mcgraw Hills, 2013	10:125906266X 13:978-1259062667
4	Engineering Mechanics	S Ramamrutham, S Chand & Co. New Delhi, 2008	8187433515 9788187433514

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1. https://www.youtube.com/watch?v=-JG9IEqRzQ4 accessed on 22nd August 2023
2. https://www.youtube.com/watch?v=4VIhh6sGkrI accessed on 22nd August 2023
3. https://www.youtube.com/watch?v=EcPGKLUE04I accessed on 22nd August 2023
4. https://www.youtube.com/watch?v=ndT35aqDfAQ accessed on 22nd August 2023
5. https://www.youtube.com/watch?v=W9UDs-kSR0g accessed on 22nd August 2023
6. https://www.youtube.com/watch?v=kuAfu0fZOLw accessed on 22nd August 2023
7. https://www.youtube.com/watch?v=Bx-mMA6k8u4 accessed on 22nd August 2023
8. https://www.youtube.com/watch?v=9XtGJXVnQxk accessed on 22nd August 2023
9. https://www.youtube.com/watch?v=k37FJHbSQA8 accessed on 22nd August 2023

XVI List of Major Equipment/Machineries with Specification:

1. Simple Axle and Wheel
2. Differential axle wheel
3. Single Purchase & Double purchase crab winch
4. Weston's Differential pulley block
5. Simple Screw Jack
6. Geared pulley block
7. Two Sheaves and Three Sheaves pulley block
8. Worm and Worm wheel
9. Jib crane apparatus
10. Beam reaction apparatus and Force table

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. H. L. Wahane	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur
2	Mr. R. D. Dongarwar	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur
3	Mr. A. Ateeque Azher	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur

(Dr. D.K.Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Secretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/AE/CM/IT/AIML/MC/PK/MT/TX/TR
Course Category	:	AEC
Course Code	:	EN101H
Course Title	:	Communication Skills

I Rationale:

Communication and proficiency in language grants an access to communicate on global platform. This course focuses on enhancing language skills like reading, listening, speaking and writing. Proficiency in English language enables a student to make connection with people around through effective communication. In engineering domain, excellence in English language enables a technician to pursue professional career and holistic development as an individual to stand strongly in the society.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Formulate English language into meaningful structures and assess the given information.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Formulate** grammatically correct sentence structures and incorporate appropriate use of vocabulary.

CO2: **Interpret** the text and appreciate literature.

CO3: **Enhance** ability to comprehend text and observe the rules of effective writing.

CO4: **Apply** communicative principles in daily activities.

CO5: **Construct** logical and meaningful sentence structures.

CO6: **Elaborate** thoughts and ideas constructively.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	2	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Application of Grammar & Vocabulary Building	1a	Use Tenses as per given situation.	1.1	Tenses: Present tense, past Tense, Future Tense and Sub types, identification and modification as per instruction.	CO1
	1b	Change the narration of given sentences.	1.2	Narration: Types of Sentence: Assertive, Imperative, Interrogative, Exclamatory. Change into Direct Speech and Indirect Speech.	
	1c	Use words effectively in given sentences.	1.3	Applying Synonyms, Antonyms, Homophones, Homonyms in given situations as per instructions.	
	1d	Enhance the understanding of word formation.	1.4	Replace a group of words/phrases with One Word Substitution.	
	1e	Construct effective sentences using idioms and phrases.	1.5	Enlist Idioms & Phrases with their meanings, make sentences using idiom and phrases.	

UNIT II: Prose	2a	Inculcate the habits to make good impression.	2.1	Abstract Summary of Dale Carnegie: Six Ways to Make People Like You-By Dale Carnegie. Read the text: Understand the 6 ways suggested by the writer. Elaborate the points using real examples. Suggest more ways that help create good impression. Display behavioral changes in yourself.	CO2
	2b	Incorporate positive attitude.	2.2	When Life Gave Me Lemons-By Rashmi Raj: Improve reading skills. Identify the important characters of the story. Associate the situation of the characters with your life. Apply the attitude suggested by the writer. Highlight the moral of the story.	
	2c	Reflect on thoughts, feelings and experiences.	2.3	Two Gentlemen of Verona- By A. J. Cronin: Read the text with correct intonations. Summarize the story in your own words. Highlight new words and write their synonyms and antonyms. Perform the story in a dramatic manner. Write a critical review.	
UNIT III: Comprehension of Seen & Unseen Passages	3a	Prioritize IQ, EQ and SQ for career building.	3.1	Be Remarkable- Naren: Read, interpret and apply the acquired principles in real life.	CO3
	3b	Enhance abilities to stand in job market.	3.2	Employers Look for Potential Employees- By Manish Sabharwal: Acquire the necessities of professional world and implement them for career building.	
unicative Skills	4a	Recognize the need of effective communication.	4.1	Introduction of communication process/cycle, definition of communication, elements of communication. Acquire the manner in which communication is conducted.	CO4

UNIT IV: Comm	4b	Recognize communication barriers.	4.2	Introduction to types of communication barriers, develop a way in which barriers to communication can be minimized so as to ensure effective interactions.	CO4
UNIT V: Writing Skills	5a	Formulate paragraphs with synchronized sentence structure on the given situation/topic.	5.1	Paragraph Writing: Structure of paragraph writing, Types of Paragraphs, Expansion of Ideas.	CO5
	5b	Develop articulation of thoughts and ideas into logical structure.	5.2	Speech Writing: : Structure of speech writing, principles of speech writing, Welcome Speech, Introducing the Guests, Vote of Thanks.	
	5c	Summarize the given information and ideas.	5.3	Note Making: Scanning and skimming of text, identifying key words in the given text, comprehend the central idea and write the gist of given text.	
UNIT VI: Speaking Skills	6a	Draft dialogues logically.	6.1	Principles of dialogue writing, format of dialogue writing, identify formal and informal conversational situations in day to day life, develop and draft dialogues on given situation.	CO6
	6b	Compose sentences to present self and others impressively.	6.2	Identify personality traits and achievements of self and others, draft the information into an effective coherent structure.	
	6c	Develop sentence structure to ask, refuse and give permission.	6.3	Asking, Giving and Refusing Permission, identify formal and informal conversational situations in day to day life, develop and draft dialogues on given situation.	

6d	Develop dialogues to practice language skills in a structured and a meaningful way.	6.4	Inquiries and Information, identify formal and informal conversational situations in day to day life, develop and draft dialogues on given situation.

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Perform Tense Busters- All levels (Language lab/Worksheets on 12 tenses).	2#	CO1
I	2	Change the narration (20 sentences from Direct into Indirect Speech).	2#	CO1
I	3	Use dictionary for vocabulary building (solve worksheet on synonyms & antonyms, homophones, homonyms & one word substitution).	2#	CO1
I	4	Enrich word power (construct 20 effective sentences using frequently used phrases & idioms).	2	CO1
II	5	Express views and counter-views based on given text.	2	CO2
II	6	Expand the idea given in a logical and structured manner.	2#	CO2
III	7	Comprehend seen passages (comprehend any three topics from unit 2/3).	2	CO3
III	8	Comprehend unseen passages (comprehend any two unseen passages).	2#	CO3
IV	9	Identify the various elements of communication in the given situation (formal/informal) and draw a communication cycle.	2#	CO4
IV	10	Identify the barriers to communication in the given situation (formal/informal) and suggest means to minimise it.	2#	CO4
IV	11	Demonstrate through role play, skills of a good communicator like news reader, commentator, RJ, announcers etc.	2	CO4
V	12	Write a paragraph on given topic (write 3 paragraphs of about 75 words on given topics).	2#	CO5
V	13	Write a book review of a book by renowned Indian author.	2#	CO5
VI	14	Introduce self and others impressively (practice self-introduction/introduction of others in formal situation).	2#	CO6
VI	15	Prepare and present speech (draft & present a speech to introduce the guests and vote of thanks speech of any departmental/institute event).	2#	CO6
VI	16	Compose & Practice conversation (compose and practice dialogues on given formal and informal situation/Role play).	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Make a list of synonyms and antonyms frequently used in spoken English (minimum 50).
2. Enlist frequently used 30 idioms, write their meanings and make sentences using them.
3. Prepare a report on Teachers' Day/Engineers' Day celebrated in your college.
4. Read a moral based story book and write a review.
5. Enlist any 50 frequently used homophones and homonyms.
6. Write a short story (in about 150 words) using past tense.
7. Write five sentences each in simple present, simple past and simple future tense .
8. Take a sentence in simple present tense and convert into remaining 11 tenses.
9. Formulate 15 words each with prefixes – dis,mis,im,en, un, anti and formulate 15 words each with suffixes – able,ful, less, ment, tion.
10. Interview a renowned personality around you and draft an interview in dialogue format.
11. Prepare a vlog on an event celebration (planning, preparation and execution).
12. Listen a audio lecture of an Indian speaker and summarize it.
13. Interact with and collect monthly budget from three households and compare and contrast them
14. Write a diary noting down your daily activities for a specified period of time.
15. Visit and write a report on a place of interest (Railway museum, Ajab Bangla, Raman Science center).

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Application of Grammar & Vocabulary Building	6	C	4	4	4	12
			O	4	4	2	10
2	Prose	6	C	6	6	2	14
			O	0	0	10	10
3	Comprehension of Seen & Unseen Passages	4	C	2	4	4	10
			O	0	4	4	8
4	Communicative Skills	4	C	2	4	6	12
			O	0	4	0	4
5	Writing Skills	5	C	0	4	6	10
			O	4	0	0	4
6	Speaking Skills	5	C	0	6	6	12
			O	0	4	0	4
Total		30	C	14	28	28	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	2R2	3R2	2A2	1R2	1R2	1A2	4R2	5	7
2	4U4	2A4	1A4	2R4	1U4			3	5
3	1U4	3A4	5U4	3U4	3A4			3	5
4	4U4	6U4	1R4	5R4	3U4			3	5
5	4A6	5A6	6U6					2	3
6	2A6	6A6	2U6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	5
2	Overall presentation of given assignment	10
3	Viva Voce	5
4	Activity	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Choice Of Topic	5
2	Analysis And Interpretation	10
3	Presentation	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	1	-	3	-	-
CO4	-	-	-	-	-	1	3	-	-
CO5	-	-	-	-	-	1	3	-	-
CO6	-	-	-	-	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	How to Win Friends and Influence people: Six ways to make people like you	Dale Carnegie, Rupa; First edition (20 May 2016)	978-8129140173
2	Two gentleman of Verona	A.J.Cronin, Oxford University Press 2013	-
3	Our muddled generation	Dinesh Kumar, Manish Sabharwal, Golden Harvest.	9788125059523
4	Contemporary English Grammar-structure and composition	David Green, Revised Edition,2004, Himalaya Publication.	033392183-6
5	Interactive English	S.K.Gangal, Revised Edition 1997 Allied Publishers.	81-7023-678-9
6	Applied English Grammar and composition	Dr. P.C. Das, 2013, New Central Book Agency.	978-81-7381-542-3
7	English for Practical Purposes	Z. N. Patil, B.S. Valke	033935098

XV e-References:

1. https://storymirror.com/read/english/story/when-life-gave-me-lemons/krd7xe09, accessed on 18th March 2021
2. https://storymirror.com/read/english/story/when-life-gave-me-lemons/krd7xe09, assessed on 25th July, 2021
3. www.talkenglish.com-grammar, assessed on 12th July, 2021
4. www.perfect-english-grammar.com, assessed on 18th March, 2021

XVI List of Major Equipment/Machineries with Specification:

1. Desktop Computers latest version
2. Headphones
3. Language lab software

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. Rupali Londhe	Lecturer in English	Government Polytechnic, Nagpur
2	Dr. M. M. Machale	Lecturer in English	Government Polytechnic, Nagpur
3	Mr. Nitin Pote	Lecturer in English	Government Polytechnic, Bramhapuri
4	Mr. Ravindra Suryawanshi	Lecturer in English	NIT Polytechnic, Nagpur
5	Mr. Nitin Pathak	Lecturer in English	Kamptee Polytechnic, Nagpur

(Mr. P. T. Khobragade)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Secretary PBOS, COMMON

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	SEC
Course Code	:	CE151H
Course Title	:	Civil Engineering Workshop Practice

I Rationale:

The course of Civil Engineering Workshop Practices would facilitate the opportunity to diploma holders to appreciate the basic construction activities. The knowledge of basics of civil Engineering operations like layout, excavation, masonry, mixing, concreting, plumbing and finishing works is essential for technician to perform his/her duties in construction industries as supervisor. Therefore, an opportunity is created through this course to develop basic skills with the safety aspects required for the same, Students should be able to supervise construction activities and use quality control techniques and use tools and equipment's with safety to self, co-workers and the constructed components of the structure.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Priotirize safety in construction and engineering practices.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Use** the relevant type of firefighting equipment in the given situation.

CO2: **Undertake** the various construction activities at site.

CO3: **Conduct** field tests on construction materials.

CO4: **Apply** form work for various concrete components of structures.

CO5: **Carry** out the specified Plumbing work in the given situation.

CO6: **Use** the relevant tools for the specified wood work.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	4	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	50	20	50	20	-	-

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Operate the fire extinguisher available in laboratory (Any two types).	4#	CO1
II	2	Prepare the report of site visit of a construction project with reference to substructure construction activities along with the equipment used.	4#	CO2
II	3	Perform the lineout activity on the site for the given type of foundation work.	4#	CO2
II	4	Conduct the market survey of the construction material through internet with reference to their properties, cost and utilities.	4#	CO2
II	5	Prepare the schematic diagram of the given structure by measuring its dimensions using measuring tape.	4	CO2
III	6	Measure dimensions of various types of bricks including checking of brick wall using in straight line, plumb and at right angle. (Group of 10 students).	4#	CO3
III	7	Transfer the marked level at the required location by using water tube level for a given construction activity.	4#	CO3
III	8	Conduct the various field test on the given sample of brick to check its quality.	4#	CO3

III	9	Conduct the various field test on the given sample of cement to check its quality.	4#	CO3
IV	10	Prepare the report of site visit of a construction project with reference to formwork and concreting construction activities along with the equipment used.	4#	CO4
V	11	Prepare the pipe line of required length using the given type of fittings.	4	CO5
V	12	Prepare a layout diagram of water supply or sanitary work of the given building.	4#	CO5
VI	13	Draw the labelled diagram of door with frame reflecting various joints with brief note on it.	4#	CO6
VI	14	Prepare a report on various types of engineering wood with their applications.	4#	CO6
VI	15	Prepare various wooden joints like Tenon & Mortise , Half Lap Joint etc.	4	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing neat sketches, selection of tools & equipment	10
2	Performance / Observation	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	2	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	2	-	-	-	-	-
CO6	3	-	-	2	-	-	-	-	2

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	PWD- Standard Data Book for Building Work.	PWD	81-219-1053-6
2	A To Z Of Practical Building Construction & its Management.	Mantri Sandeep	9788176842051
3	Hand Book of Civil Engineering By GKP.	Praveen Dwivedi & Prachi Bajpa	9789391061272
4	Handbook of Civil Engineering.	V. N. Vazirani	8174092277
5	Building Construction	Sushil Kumar	9788180141683

XV e-References:

1. http://www.asnu.com.au. Accessed on 23 Oct 2023.
2. www.mahapwd.com/ Accessed on 23 Oct 2023.
3. https://wrd maharashtra.gov in/ Accessed on 23 Oct 2023.
4. https://theconstructor.org/building/types-bonds-brick-masonry-flemish-english-wall/11616/ Accessed on 23 Oct 2023.
5. https://dailycivil.com/types-of-joints-in-plumbing/ Accessed on 23 Oct 2023.

XVI List of Major Equipment/Machineries with Specification:

1. Fire buckets of standard size.
2. Fire extinguisher (Type A, B, C and ABC).
3. Measuring Tape (3 meter, 15meter, 30meter).
4. Ordinary Portland Cement (43, 53 grade).
5. Raw material such as bricks of standard size 230 mm x 115 mm x 75 mm.
6. Trowels (Brick, Buttering, Pointing), triangular, ranging in size up to about 11 inches (279.40 mm) long and from 101.6 mm to 203.2 mm wide i.e. (4 to 8 inches wide).
7. Portable Hammer, Spade, Pans (ghamela), Thread, lime.
8. Square, mason's level, and straightedge 28.57 mm to 38. 10 mm and the middle 4 portion of the top edge from 152.40 mm to 254 mm wide
9. Levels and mason's line, brushes.
10. String Level/Water tube, Plumb bob. Right Angle.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	Head, Civil Engineering	Government Polytechnic, Nagpur
2	Mtr. A. J. Fulzele	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur.
6	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/MT/TX/IT/CM/AE/AI/MK/TR
Course Category	:	SEC
Course Code	:	CM151H
Course Title	:	Basics of Computers

I Rationale:

Computer is an essential tool that we cannot avoid as it plays an important role in our day to day life, especially in the present scenario. Basics of Computer course starts with the basic computer skills, learning basic application software tools, Understanding Computer Hardware, Basic Internet awareness. This course will be taken online under spoken tutorial courses IIT, Bombay.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use computer for Documentation, Presentation, Analyse data and different internet services.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** the basics of computer fundamentals.

CO2: **Install** and configure printer setting.

CO3: **Identify** Basic Internet skills.

CO4: **Recognize** various email components.

CO5: **Illustrate** the use of google drive.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	2	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)	Topics and Sub-topics	Aligned Cos

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify various Input/output devices of computer.	2#	CO1
I	2	Connect the various components of computer.	2#	CO1
II	3	Connect printer to computer and apply its setting.	2#	CO2
II	4	Configure the setting of printer and print the test page.	2#	CO2
II	5	Apply page layout features such as Themes, page background, paragraph,page setup. Create multicolumn page. Use different options to print the documents	2#	CO2
III	6	Use internet for different web services.	2	CO3
III	7	Create a new google account and login to gmail account.	2#	CO3
III	8	Write and compose an email to given email account.	2#	CO3
III	9	Send an email to given recipients.	2#	CO3
III	10	Use mail merge with options.	2	CO3
IV	11	Compose and attach files to e-mails.	2#	CO4
IV	12	Share of files and folders using google drive.	2#	CO4
IV	13	Insert a photo or link into an email and about the compose window options.	2	CO4
V	14	Create , open and edit worksheet.	2#	CO5
V	15	Apply Page setup and print options for worksheet to print the worksheet.	2#	CO5
V	16	Prepare a slide presentation and apply design theme to given presentation.	2#	CO5
V	17	Add new slides and insert pictures/images, shapes on presentation.	2#	CO5
V	18	Add table and charts in the slides.	2#	CO5
V	19	Create a word document and use different option on document.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a document on Report of Various Printer types.
2. Prepare Notes using Document/Office.
3. Prepare Study Report using Document/Office.
4. Prepare Playbill (salary statement, tax statement) using spreadsheet.
5. Prepare a time table using Spreadsheet
6. Prepare student Mark sheet using spreadsheet.
7. Prepare presentation for advertisement.
8. Prepare presentation of your Branch/Department.
9. Prepare presentation of Study Report.
10. Prepare presentation on Various Components of Computer.
11. Prepare Google Form in Drive and share.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

-----NA-----

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	selection of proper tool,execution	5
2	Complete the practical in stipulated time	10
3	Performance	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Topic	5
2	Content of Report/Assignment	10
3	Submission of Report	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-
CO5	3	-	-	3	-	-	-	-	-
CO6									

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Computer Fundamentals	R.S. Salaria Khanna Publishing House	13: 978-938-1068533
2	Computer Course Made Easy	Ramesh Bangia, Khanna Book Publishing Company, First Edition, 2014	13: 978-938-2609377
3	Internet Applications	Ikvinderpal Singh, Khanna Book Publishing Company, First Edition, 2011	10: 938-1068399

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1. https://spoken-tutorial.org/tutorial-search/?search_foss=Introduction+to+computers &search_language= accessed
2. https://www.latex-tutorial.com/tutorials/ accessed on 22/6/2022
3. http://www1.maths.leeds.ac.uk/LaTeX/TableHelp1.pdfaccessed on 22/6/2022
4. https://www.wikihow.com/Create-a-Website-Using-Google-Sites accessed on 22/6/2022
5. http://www.tutorialsforopenoffice.org/accessed on 22/6/2022

XVI List of Major Equipment/Machineries with Specification:

1. Computer system with latest configuration.
2. Any Office software or latest version
3. PC tools
4. Any operating system
5. printer
6. Spokent Tutorials IIT bombay study materials

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.M.V.Sarode	HOD, Computer Engineering	Government Polytechnic, Nagpur
2	Mr P S Thakre	Lecturer in Computer Engineering	Government Polytechnic, Nagpur
3	Dr U B Aher	Lecturer in Computer Engineering	Government Polytechnic, Nagpur
4	Mrs D S Nalinde	Lecturer in Computer Engineering	Government Polytechnic, Nagpur
5	Mrs.V.A.Raje	System Analyst	MSBTE,RO,Nagpur
6	Mr. Dipak Dhote	Operations Manager	IT-Network, Nagpur
7	Dr. Rakesh Kadu	Assistant Professor	Ramdeobaba COEM,Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/MT/PK/AE/TR/TX/ MK/AI
Course Category	:	VEC
Course Code	:	VE151H
Course Title	:	Integrated Personality Development

I Rationale:

This course aligns with the National Education Policy by fostering holistic development in engineering students, emphasizing values, resilience, and personal growth. It builds essential life skills such as leadership, effective communication, project management, and national pride, enhancing students' adaptability in both personal and professional settings. Through diverse learning experiences, students gain practical insights and develop a balanced, informed perspective essential for responsible, impactful careers.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Demonstrate leadership, effective communication, project management, and resilience in professional and personal environments.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Enhance** personal growth by mastering thought-processes, building productive habits, and managing social media impact.

CO2: **Develop** inspiration from Indian icons by applying lessons from their resilience, values, and leadership qualities.

CO3: **Enhance** communication skills by actively listening and bridging generational gaps to strengthen family connections.

CO4: **Build** resilience by adopting a positive outlook, learning from failures, and embracing faith in daily life.

CO5: **Foster** national pride by exploring, researching, and sharing insights about India's rich historical heritage.

CO6: **Develop** professional skills by building networks, adopting leadership qualities, and practicing effective project management.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	2	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	25	10

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
UNIT I: Remaking Yourself	1	**Restructuring Yourself:** Develop intellectual, physical, emotional, and spiritual quotients by learning six powerful thought-processes.	2#	CO1
	2	**Power of Habit:** Develop good habits in life by undergoing a study of how habits work, the habits of successful professionals, and the practical techniques.	2#	CO1
	3	**Handling social media:** Learn how social media can become addictive and imbibe simple methods to take back control.	2#	CO1
UNIT II: Learning from Legends	4	**Sachin Tendulkar and Ratan Tata:** Learn from the inspirational lives of India's two legends, Sachin Tendulkar and Ratan Tata & implement lessons through related case studies.	2#	CO2
	5	**A.P.J. Abdul Kalam:** Learn from Dr Kalam's inspirational life displayed legendary qualities such as Dare to Dream, Work Hard, Get Good Guidance, Humility, and Use Your Talents for the Benefit of Others.	2#	CO2

UNIT III: From House to Home	6	**Active Listening & Understanding:** Learn to listen with eyes, ears, mind, and heart, for academic progress and communications.	2#	CO3
	7	**Bonding the Family:** Overcome the generation gap and connect with their family more.	2#	CO3
UNIT IV: Facing Failures	8	**Welcoming Challenges:** Learn to face difficulties through a positive perspective, through the study of successful figures such as Disney, Lincoln and Bachchan.	2#	CO4
	9	**Significance of Failures:** Acquire constructive skills to understand failure as formative learning experiences.	2#	CO4
	10	**Power of Faith:** Learn the power and necessity of faith in our daily lives.	2#	CO4
UNIT V: My India My Pride	11	**Our Nation:** Learn the importance of studying India's glorious past so that they could develop a strong passion and pride for our nation.	2#	CO5
	12	**India's Glorious Past:** Develop a deeper interest in India's glorious past by appreciating the need to read about it, research it, write about it, and share it.	2#	CO5
UNIT VI: Soft Skills	13	**Networking & Leadership:** Learn the means of building a professional network and developing a leadership attitude.	2#	CO6
	14	**Project Management:** Learn the secrets of project management through the Akshardham case study and practice project management skills through an activity relevant to student life.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Perform Selfless Service - Seva: Learn the benefits of performing seva and prepare report showing evidences.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Content Understanding	10
2	Readability	5
3	Completeness	5
4	Viva voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Originality of work	5
2	Organization and Writing	5
3	Use of Evidence	5
4	Viva voce	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	3	3	3	-	-
CO2	-	-	-	-	3	3	3	-	-
CO3	-	-	-	-	3	3	3	-	-
CO4	-	-	-	-	3	3	3	-	-
CO5	-	-	-	-	3	3	3	-	-
CO6	-	-	-	-	3	3	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Integrated Personality Development Course Workbook-1	IPDC Team, Swaminarayan Aksharpith, Shahibaug, Ahmedabad- 4, India, 2nd Edition 2021.	13: 978-81-7526-702-2
2	Wings of Fire: An Autobiography	A.P.J. Abdul Kalam, Arun Tiwari (Contributor), Universities Press, 67th Edition 2023	13: 978-817371466
3	The Wit & Wisdom of Ratan Tata	Ratan Tata, Hay House India, January 2016	10: 9789385827297 13: 978-9385827297
4	Chase Your Dreams	Sachin Tendulkar, Hachette India, October 2017	10: 9351951995 13: 978-9351951995

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1. Julian Treasure: 5 ways to listen better | TED Talk accessed on 7th July, 2023
2. Listening Statistics: 23 Facts You Need to Hear (creditdonkey.com) accessed on 7th July, 2023
3. Robert Waldinger: What makes a good life? Lessons from the longest study on happiness | TED Talk accessed on 7th July, 2023
4. The Story Behind the Selfless Love of Ahmedabad's Seva Cafe (thebetterindia.com) accessed on 7th July, 2023
5. What Are Soft Skills? Definition, Importance, and Examples (investopedia.com) accessed on 7th July, 2023
6. Welcome to Mystic India accessed on 7th July, 2023

XVI List of Major Equipment/Machineries with Specification:

1. Desktop Computer, Latest Configuration
2. DLP, Latest Configuration
3. Smart Classroom with internet connection

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M.B.Daigavane	Principal	Government Polytechnic, Nagpur
2	Mr. Y.K.Chandarana	HoD, Applied MechanicsEngineering	Government Polytechnic, Nagpur
3	Dr. G. K. Awari	HoD, Automobile Engineering	Government Polytechnic, Nagpur
4	Dr. G.V. Gotmare	I/C, Curriculum Development Cell	Government Polytechnic, Nagpur
5	Dr. Megha Machale (Bhelande)	Lecturer in English	Government Polytechnic, Nagpur

(Dr. G.V.Gotmare)
HOD & Chairman PBOS, COMMON

(Dr. G.V.Gotmare)
Member Secretary PBOS, COMMON

Semester

II

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/CM/IT/AE/PK/MT/AI
Course Category	:	DSC
Course Code	:	MH102H
Course Title	:	Applied Mathematics

I Rationale:

Mathematics is the backbone of technical courses, Understanding of engineering concepts require logical approach and thinking. The course is extension of Basic Mathematics of first semester and stepping up into the prerequisites to learn Calculus and Numerical method. Applied Mathematics lay down the foundation to understand and express principles and laws involved in other Technological courses.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the concept of Mathematics to solve industry-based technological problems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** the concept of functions to Identify and find the value, Range, Domain,Co-Domain of the given function.

CO2: **Apply** methods of evaluation of limit to solve the given examples of limits.

CO3: **Apply** the concept of limit, define the first principal of derivatives, notation, understood the Rules to solve the examples of derivatives.

CO4: **Solve** indefinite and definite integral problems using integral of standard function, rules, and methods.

CO5: **Apply** the concept of differential equation which helps to solve engineering problems.

CO6: **Apply** various numerical methods to solve algebraic and simultaneous equations.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	2	-	2	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	-	-	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Functions	1a	Find the Range, Domainand Co-Domain of the given function.	1.1	Concept of function, Domain, Co-Domain, and Range of the Functions.	CO1
	1b	Find the value of given Function.	1.2	Value of a function.	
	1c	Identify the type of given functions.	1.3	Types of functions:- Logarithmic, Inverse, Algebraic, Trigonometric, & Inverse (LIATE)	
	1d	Check whether the given function is odd or even function.	1.4	Even and odd Function, Parametric, Composite Implicit, Explicit Functions.	
NIT II: Limits	2a	Evaluate limit of the given function by using Algebra of limits.	2.1	Concept of limit. Algebra of limits. (Addition Subtraction, Multiplication & Division). Limits of algebraic functions (By Direct Method, Factorisation, Rationalisation Method).	CO2
	2b	Solve the limit of given trigonometric function, & limit based on infinity type.	2.2	Limits of Trigonometric function, Limit based on x tends to infinity.	

UI	2c	Evaluate limits of the given exponential functions.	2.3	Limits of Exponential Functions.	
	2d	Evaluate the given logarithmic limit and Exponential limit.	2.4	Exponential Limits & Logarithmic Limits, Use of Logarithmic Limits for Exponential Limits.	
UNIT III: Derivetive	3a	Find the derivatives of given function using derivatives of standard function formulae by using Rules of Derivatives.	3.1	First principle of derivatives and Notations (without proof), Derivatives of standard function. (LIATE), Rules for differentiation (without proof) Addition, Subtractions, Multiplication, & Division.	CO3
	3b	Find the derivatives of given composite, inverse and inverse trigonometric, implicit, explicit, parametric, and exponential functions.	3.2	Derivative of composite, inverse and inverse trigonometric, implicit, explicit, parametric, and exponential functions.	
	3c	Differentiate the given function w.r.t. another function.	3.3	Logarithmic differentiation, & Derivatives of one function with respect to another function.	
	3d	Find the second order derivatives of the given function.	3.4	Second order differentiation.	
UNIT IV: Integrations	4a	Evaluate the given integral by substitution method.	4.1	Concept of Integration as a anti derivatives, Integral of standard function (LIATE), Rules of integration. Integration by substitution method.	CO4
	4b	Evaluate the integral of given composite function, rational function, and trigonometric function.	4.2	Integration of Algebraic Rational function, composite function, and trigonometric function.	
	4c	Evaluate the integral of given function by using parts and partial fraction.	4.3	Integration by partial fraction and by parts.	
	4d	Evaluate the given definite integral by using properties.	4.4	Definite integral and their properties.	

UNIT V: Differential Equation	5a	Solve given Differential equations of first order and first degree by variable separable method and reduce the given differential equation to variable separable form.	5.1	Concept of differential equation, Order and degree of differential equation, Formation of differential Equation. Methods of solving Differential equation of first order and first Degree. (a)Variable separable Method. (b) Equation reducible to variable separable form.	CO5
	5b	Check and solve the given exact differential equation.	5.2	Exact differential equation	
	5c	Solve the given Homogeneous differential equations.	5.3	Homogenous differential equation	
	5d	Solve the given Linear differential equations.	5.4	Linear differential equation	
	5e	Solve the given Bernoulli's differential equations.	5.5	Bernoulli's differential equations.	
UNIT VI: Numerical Methods	6a	Find the approximate root of algebraic equation by using given method.	6.1	Identification of root of algebric equation. Solution of algebraic equation by, Bisection method, Regula-Falsi method, Newton-Raphson method.	CO6
	6b	Solve the system of Simultaneous equations containing three unknowns by using given method.	6.2	Solution of Simultaneous Equations containing three unknowns by, Gauss elimination method. Iterative methods: Gauss-Seidal & Jacobi's method.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Find value of any given function.	2#	CO1
II	2	Find limits of algebraic, trigonometric, and exponential functions.	2#	CO2
III	3	Solve examples on derivative using algebraic operations.	2#	CO3
III	4	Find dy/dx of implicit functions.	2#	CO3
III	5	Find dy/dx of parametric functions and inverse trigonometric functions.	2#	CO3
III	6	Find the higher order derivatives of the given function.	2#	CO3
IV	7	Solve examples, integration of rational, algebraic, and composite function.	2#	CO4
IV	8	Solve examples using rules of integration and substitution method.	2#	CO4
IV	9	Solve examples using integration by parts and partial fraction method.	2#	CO5
IV	10	Solve the examples of Definite integral.	2#	CO5
IV	11	Evaluate definite integral using properties.	2#	CO5
V	12	Solve differential equation using variable separable method and reducible to variable separable.	2#	CO6
V	13	Solve Exact, homogenous, linear and Bernoulli's differential equation.	2#	CO6
VI	14	Find the approximate root of algebraic equation.	2#	CO6
VI	15	Solve the system of simultaneous equations.	2#	

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare the list of function which are related with your branch. Identify the types of function, Find the values of the given functions for the particular value.
2. Calculate the limit of the given function by using Laws of Limits.
3. Prepare the list of standard formulas of Derivatives.
4. Find the Derivatives of given functionb by using Laws of Derivatives.
5. Prepare the list of practical experiment in which the derivatives used.
6. Prepare the list of formulas of standard Integration.
7. Evaluate the integration of the given function by rules, Laws and property of definite Integral.
8. Prepare the list of experiment in which the Integration used in your course.
9. Find th order and degree of the given differential Equation.
10. Form the Differential equation for the given solution.
11. Solve the given differential by using Methods and prepare the list of Methods to solve the given Differential equation.
12. Prepare the procedure of Bisection Method, Regula Falsi's methods, Newton Raphason Methods to find the solution of given function.
13. Prepre the procedure of Gauss's Elimination Method, Jacobi's methods, Gauss' Seidal Methods to find the solution of set of simultaneous eqution.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Functions	5	C	02	00	04	6
			O	00	04	00	4
2	Limits	8	C	00	04	04	8
			O	00	02	00	2
3	Derivetive	14	C	04	04	06	14
			O	00	04	04	8
4	Integrations	14	C	04	00	08	12
			O	04	04	00	8
5	Differential Equation	5	C	00	04	08	12
			O	02	00	04	6
6	Numerical Methods	14	C	00	12	06	18
			O	00	00	12	12
Total		60	C	10	24	36	70
			O	6	14	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	3R2	3R2	4R2	4R2	5R2	2U2	5	7
2	1U4	2U4	3U4	1A4	2A4			3	5
3	4R4	3U4	4U4	3A4	4A4			3	5
4	4U4	4A4	5A4	5A4	5A4			3	5
5	6U6	3A6	6A6					2	3
6	6U6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Attendance (Regularity And Awareness About Performing Assignment)	5
2	Assignment Contents (25-30 examples is compulsory on each unit)	15
3	Completion of Assignment, NeatnessAnd cleanliness of maintaining Assignment Copy.	5
4		
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Interest And Awareness About Performing Assignment	5
2	Assignment Contents	15
3	Completion of Assignment, Neatness And cleanliness of maintaining Assignment Copy.	5
4		
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	1	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	1	1	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Engineering Mathematics	P N Wartikar, Pune Vidyarthi Griha Prakashan	4567155742
2	Calculus of One Variable	IA Maron, Publisher: Arihant, 5th Edition 2015	9352030559
3	Engineering Mathematics	S.S .Shastry,Prentice Hall Of India, 4th edition 2008	9788120336162
4	Engineering Mathematics	D.T. Gaikwad, S Chand Publication, 1st edition 2010	8121933560
5	Higher Engineering Mathematics	B S Grewal, Publisher: S Chand, 43rd edition 2014	9788174091955
6	Higher Engineering Mathematics	Khanna Publication New Delhi, B.S.Grewal	8174091955

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1. https://msbte.org.in/msbtelectures.html assessed on 24th Sept. 2023
2. https://www.khanacademy.org assessed on 24th Sept. 2023
3. https://www.youtube.com/watch?v=5_TuK1yCPD4 assessed on 24th Sept. 2023
4. http://nptl.ac.in/course/106102064(online Learning Initiatives By IITs and IISc) assessed on 24th Sept. 2023
5. https://www.khannacademy.org/mathqgelid=CnqHuabCys4CFdOJaddHoPig assessed on 24th Sept. 2023

XVI List of Major Equipment/Machineries with Specification:

1. Nil
2. ...
3. ...

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. P.T. Khobaragade	I/C Mathematics Dept.	Govt. Polytechnic Nagpur
2	Mr. S.M. Sayyed	Ex-Lecturer	Govt. Polytechnic Nagpur
3	Mr. G.R. Dewalkar	Lecturer	Govt. Polytechnic Nagpur
4	Dr. P. B. Bahatkar	Professor	Y. C. C. E. Nagpur
5	Mr. V.M.Meshram	Ex-Lecturer	Govt. Polytechnic Nagpur

(Mr. P.T. Khobaragade)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Secretary PBOS, COMMON

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/MK/IT/CM/MT/PK/AE/TX/MK/AIML
Course Category	:	DSC
Course Code	:	PH101H
Course Title	:	Applied Physics

I Rationale:

Physics is the foundation of engineering and technology which help to develope the ability of technical skills for those students who wish to pursue higher study in engineering field. Without the concept and application of physics there cannot be technology development. Study of physics develops the ability of problem solving, logical thinking and also the ability to think intellectually. Fundamental principle and scientific knowledge of physics is used for technology innovation to develop new surrounding that benefits new mankind which is important to society and nature, making everything easier around us.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply principles of physics to solve broad based relevant engineering problems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Determine** physical quantities using proper measuring instruments.

CO2: **Solve** fundamental engineering problems using law of electricity and magnetism.

CO3: **Apply** the fundamental principles of heat and optics for engineering applications.

CO4: **Apply** principles of wave motion, acoustics and radioactivity for engineering applications.

CO5: **Use** LASER, X-rays and photoelectric cell for industry applications.

CO6: **Use** nanotechnology and Non-Destructive Testing (NDT) for various applications in engineering field.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	-	2	2	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: General Properties of Matter	1a	Estimate the error in the measurement for a given data.	1.1	Errors, Type of error, instrumental, systematic, and random error, Estimation of error, Absolute, Relative and Percentage error.	CO1
	1b	Calculate Least Count (LC) and range of given instruments.	1.2	Ancient Indian Astronomical Instrument: water clock (Ghati Yantra), Gnomon (Shanku), Crossed Staff (Yasti Yantra). Modern measuring instruments: Least count and range of Vernier caliper, outside micrometer screw gauge and travelling microscope.	
	1c	Compare deformation in given bodies by the action of external deforming force.	1.3	Elasticity, Plasticity, Rigidity. Stress and Strain with their types, Elastic Limit, Hook's Law, Types of modulus of Elasticity, Stress-Strain curve, Applications of elasticity, Numerical based on above.	

	1d	Determine the coefficient of viscosity of the given fluid using the law of viscosity for given data.	1.4	Viscous force, Definition of viscosity, Newton's law of viscosity, Stoke's law, (Statement and formula only), Coefficient of viscosity and S.I. unit. Types of flow of liquid, Reynold's number, Terminal velocity and Application of viscosity.	
UNIT II: Basic Electricity	2a	Calculate the force of attraction or repulson between two charges for a given data.	2.1	Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference, Numerical based on Coulomb's inverse square law, Electric field intensity.	CO2
	2b	Solve problems based on Magnetic field intensity and Magnetic flux.	2.2	Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux.	
	2c	Apply the law of series and parallel combination to the given electrical circuit.	2.3	Ohm's law, specific resistance, laws of series and parallel combination of resistance, calculation of resultant resistance of given resistances in series and parallel combination, Heating effect of electric current, Joule's Law, Numerical based on above.	
	2d	Differentiate materials on the basis of given energy band diagram.	2.4	Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors	
d Fiber Optics	3a	Select the modes of transmission of heat for given materials.	3.1	Heat and Temperature: Heat, temperature, Absolute zero temperature, different temperature scale, Three modes of transmission of heat. Good and bad conductor of heat with examples, Law of thermal conductivity and S.I. units.	

UNIT III: Thermometry an	3b	Determine given parameters of gas by applying gas laws.	3.2	Boyle's law, Charle's law, Gay Lussac's law, General gas equation, Applications of gas laws and calculation of pressure, volume or temperature using gas laws.	CO3
	3c	Differentiate different type of optical fibre with their application.	3.3	Reflection, Refraction, Snell's law, Optical fiber, Structure of optical fiber, Principle of Optical fiber-Total Internal Reflection, Type of optical fibre and applications of Optical Fiber.	
UNIT IV: Wave Motion and Radioactivity	4a	Classify the given types of waves by their characteristics.	4.1	Definition of wave motion, amplitude, period, frequency & wavelength, relation between velocity, frequency & wavelength. Progressive wave, Stationary waves, longitudinal and transverse wave. Node, Antinode. Ultrasonic wave, Properties, and application.	CO4
	4b	Calculate velocity of sound with end correction on given data.	4.2	Definition of resonance with example. Formula for velocity of sound with end correction, calculation of velocity of sound with the help of resonance tube.	
	4c	Compare the properties of radioactive rays on the basis of given parameters.	4.3	Radioactivity, α, β and γ rays and their Properties, Advantages, and disadvantages of Radioactivity.	

UNIT V: Modern Physics (Photoelectricity, LASER, X-Rays)	5a	Calculate work function, energy, threshold frequency and threshold wavelength for a given data.	5.1	Photon, properties of photons, Planck's hypothesis, Threshold frequency, threshold wavelength and Stopping potential. Work function, Photoelectric effect with characteristics properties. Principle, Construction and working of Photoelectric cell with applications. Einstein's photoelectric equation. (Numerical based on above)	CO5
	5b	Apply the fundamental concepts of LASER in given engineering fields.	5.2	Properties of laser, Types of laser, absorption, spontaneous and stimulated emission. Definition of Pumping and its type, Population inversion, Metastable state. Applications of LASER in Engineering and biomedical field.	
	5c	Describe the production of X-rays of the given materials with properties and applications.	5.3	Introduction to X-rays, Properties of X -rays, production of X-ray using Coolidge tube. Applications of X-rays in Engineering, medical and scientific field.	
UNIT VI: Nanotech-nology and Non Destructive Testing.	6a	Calculate surface area per volume ratio of given objects.	6.1	Definition of nanoscale, nano-meter, nanoparticle, determination of surface area per volume ratio of objects, application of nanotechnology in Engineering and Technology, medical, cosmetics, environmental, space and defence.	CO6
	6b	Compare DT and NDT methods on the basis of given points.	6.2	Non-Destructive Testing (NDT), comparison of DT and NDT, Various NDT methods used, Criteria for the selection of NDT method, Merits and Demerits of NDT.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the various instruments used in Physics laboratory and follow precautionary measures.	2#	CO1
I	2	Measure the outer diameter of a cylindrical body by Vernier Calliper.	2#	CO1
I	3	Calculate the diameter of a small spherical body by Outside micrometer screw gauge.	2#	CO1
I	4	Calculate the value of Young's modulus of elasticity of given wire.	2#	CO1
I	5	Determine the coefficient of viscosity of given fluids by Stoke's method.	2	CO1
II	6	Calculate mechanical equivalent of heat, J by electrical method.	2#	CO2
II	7	Use magnetic compass to draw the magnetic lines of forces of bar magnet.	2#	CO2
II	8	Calculate the resultant resistance of given resistances in series combination.	2#	CO2
II	9	Calculate the resultant resistance of given resistances in parallel combination.	2#	CO2
III	10	Analyze the effect of volume on pressure at constant temperature.	2#	CO3
III	11	Calculate critical angle of incidence for a given glass slab to verify total internal reflection phenomenon.	2	CO3
IV	12	Determine inner diameter of resonance tube using Vernier Calliper.	2#	CO4
IV	13	Find the velocity of sound with the help of resonance tube.	2#	CO4
V	14	Find the angle of divergence of Laser beam.	2	CO5
VI	15	Calculate the surface area (SA), volume (V) and SA/V of an object and measure dimensions required for it.	2#	CO6

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect different solid materials. Classify them into elastic, plastic and rigid bodies on the basis of Hooke's law and prepare a report on it.
2. Collect viscous liquids and prepare a working model to differentiate the liquids on the basis of viscosity.
3. Prepare a prototype vernier caliper of desire least count using card sheet.
4. Prepare model of heating effect of electric current on aluminium and nichrome wire.
5. Prepare model of series and parallel resistances using household materials.
6. Perform comparative analysis of series and parallel combination of resistances using LED, resistor and connecting wires.
7. Prepare demonstrative model of simple electromagnet by using law of electricity and magnetism.
8. Plot the magnetic lines of forces for U-shaped magnet using magnetic compass.
9. Construct a simple ON-OFF Circuit on breadboard using semiconducting devices.
10. Prepare model to demonstrate magnetic lines of forces of different types of magnets.
11. Prepare a report on conducting and non-conducting material and differentiate good conductor and bad conductor among the collected material such as metal and plastic etc.
12. Collect different conducting and non-conducting materials and construct ON OFF circuit using resistors, LED, connecting wires to differentiate good and bad conductors within the collected materials.
13. Prepare a working model to demonstrate Total Internal Reflection (TIR) by using water and diode laser.
14. Prepare a simple model of projector using fundamental principle of optics.
15. Use diode LASER to differentiate LASER with ordinary source of light.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	General Properties of Matter	8	C	02	02	04	8
			O	00	00	04	4
2	Basic Electricity	8	C	02	04	06	12
			O	00	04	04	8
3	Thermometry and Fiber Optics	12	C	04	06	04	14
			O	02	06	00	8
4	Wave Motion and Radioactivity	12	C	04	06	04	14
			O	04	04	00	8
5	Modern Physics (Photoelectricity, LASER, X-Rays)	14	C	02	04	10	16
			O	02	00	06	8
6	Nanotech-nology and Non Destructive Testing.	6	C	02	04	00	6
			O	00	00	04	4
Total		60	C	16	26	28	70
			O	8	14	18	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	1U2	5R2	6R2	3R2	5R2	5	7
2	3R4	2U4	1A4	2U4	1A4			3	5
3	3A4	4R4	4A4	2A4	4R4			3	5
4	5A4	5U4	6A4	6U4	4U4			3	5
5	3U6	2A6	3U6					2	3
6	4U6	5A6	5A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Sources of information	5
2	Scientific Approach	10
3	Timely submission	5
4	Conclusion / Interpretation	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	2	-	-	3	-	-
CO2	3	-	-	2	-	-	3	-	-
CO3	3	-	-	-	-	-	3	-	-
CO4	3	-	-	2	2	-	3	-	-
CO5	3	-	-	2	2	-	3	-	-
CO6	3	-	-	-	2	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Modern Physics	B.L.Thereja, S. Chand & Company Ltd 5th Edition, 2014	13:978-8-12-190163-5
2	Engineering Physics	V.Rajendran, The McGraw Hill Education Pvt. Ltd,1st Edition, 2010	13: 978-0-07-107014-0
3	Conceptual Physics	P.G.Hewitt, San Francisco Addison Wesley- 10th Edition, 2006	13: 9780321909107
4	Engineering Physics	R.K.Gaur And S.L.Gupta, Dhanpatrai Publication New Delhi, 1987	97-8-18-992822-3
5	A Textbook of Engineering Physics	M N Auadhanulu, S Chand Publication, 2008	8121908175, 9788121908177
6	Fundamental of Physics	Dvid Halliday, Robert Resnick, Jearl Walker	13:978-0471524618, 10:0471524611

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1. https://www.britannica.com/science/viscosity,assessed on 18th Aug 2023.
2. https://www.livescience.com/58816-photoelectric-effect.html, assessed on 19th Aug 2023.
3. https://www2.lbl.gov/abc/wallchart/chapters/03/4.html, assessed on 18th Aug 2023.
4. https://www.sanskritimagazine.com/ancient-indian-astronomical-instruments-of-bhaskaracharya/ assessed on 24th Aug 2023.
5. https://easyelectronics.co.in/ultrasonic-waves/ assessed on 24th Aug 2023.
6. https://www.keyence.co.in/ss/products/measure-sys/measurement-selection/basic/error.jsp assessed on 23rd Aug 2023.

XVI List of Major Equipment/Machineries with Specification:

1. Vernier Caliper (Least count= 0.01 cm and range= 0 to 12 cm)
2. Screw gauge (Least count= 0.001 cm and range= 0 to 2.5 cm)
3. Young' Modulus- Searle's apparatus with micrometer reading 0.001 cm.
4. Travelling microscope (vertical and horizontal scales with range 0- 15 cm with least count 0.001 cm)
5. Resonance apparatus with glass tube and metal reservoir (L= 0- 100 cm)
6. Tunning fork -256, 320, 384, 428, 480, 512 Hz.
7. Boyle's apparatus iron base double steel rod, 25 ml fitted with leveling screw on base
8. Stoke's apparatus with glass tube 50 cm.
9. Joule's calorimeter with mass 198 cal/gms.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mrs. S. B. Adulkar	Lecturer	Government Polytechnic, Nagpur
2	Dr. A. R. Karule	Lecturer	Government Polytechnic, Nagpur
3	Mr. A. J. Khobragade	Lecturer	Government Polytechnic, Nagpur
4	Mr. D. D. Bodele	Lecturer	Government Polytechnic, Nagpur
5	Dr. S. B. Raut	Lecturer	Government Polytechnic, Gondia
6	Dr. A. M. Dabhade	Lecturer	Government Polytechnic, Bramhapuri.
7	Mr. A. D. Ningurkar	Lecturer	Government Polytechnic, Bramhapuri.

(Mr. P. T. Khobragade)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Secretary PBOS, COMMON

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE101H
Course Title	:	Construction Materials

I Rationale:

Construction material is the key element in the construction project. A diploma civil engineer has to constantly deal with selection of materials for various engineering project of constructions such as residential/ commercial buildings, roads, metro, railways, bridges, dams, tunnels and fly-over. The development of advance technology generates the necessity of new engineering materials. It is a challenging job for the civil engineer to select relevant material which is durable, economical and eco-friendly. New materials are introduced every day in the market, Modern techniques are developed to handle and use materials for economic and safer designs of engineering structure. At diploma level students are expected to study about these aspects so as to develop their understanding performance oriented abilities in order to apply their knowledge in construction industry goals.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply safe building construction practices.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** relevant construction materials for given construction work.

CO2: **Select** natural construction material for construction.

CO3: **Select** artificial construction material for given construction activity

CO4: **Select** special construction material for given construction.

CO5: **Select** finishing construction material for required finish.

CO6: **Select** processed construction material for given construction.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	-	1	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	-	-	-	-	25	10

** Online Objective type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Overview of Construction Material	1a	Identify the scope of construction material in the given field of civil engineering.	1.1	Scope of construction materials in Various Civil Engineering Works. (applications only).	CO1
	1b	Classify the given construction material according to sources with examples.	1.2	Broad classification of materials, Natural, Artificial, special finishing and recycled, Sources of materials.	
	1c	Suggest the construction material to be used in the given situation with justification.	1.3	Selection of materials for different civil engineering structures on the basis of strength, durability, eco friendliness and economy.	
ral Construction Material	2a	Select the stone for construction based on requirement for construction purpose.	2.1	Requirements of good building stone; general characteristics of stone: dressing methods and tools for stone.	CO2
	2b	Select timber for use in civil work	2.2	Structure of timber, general properties of good timber, seasoning, preservation and defects in timber and its uses, Uses of bamboo in construction.	
	2c	Identify the uses of Asphalt, bitumen and tar used in construction.	2.3	Asphalt, bitumen and tar used in construction. Properties and their uses.	

UNIT II: Natu	2d	Select the relevant type of lime for the given purpose in construction work with justification.	2.4	Properties of lime- its types and its uses.	
	2e	Select the required quality of Soil, sand and coarse aggregates to be used in construction.	2.5	Type of soil and its suitability as foundation, Classification of coarse aggregate according to sizes and its uses, Properties of sand and uses.	
UNIT III: Artificial Construction materials	3a	Identify the stages of manufacturing process of Cement in flow chart	3.1	Ingredients of cement, Types of cement and its uses. Manufacturing process of Cement - dry and wet (only flow chart),	CO3
	3b	Select the properties, ingredients, uses of the given type of brick.	3.2	Constituents of Brick earth. Conventional / Traditional bricks, Modular and Standard bricks, Characteristics of good brick, Classification of burnt clay bricks and their suitability. Special bricks. Manufacturing process of burnt clay brick.	
	3c	Suggest type of flooring material for a given situation with justification.	3.3	Flooring tiles – Types- Vitrified, Ceramic, Kota, marble and Granite- uses, Industrial Flooring,	
	3d	Select the type of precast concrete product for the given civil structure with justification	3.4	Pre-cast concrete blocks- hollow, solid, pavement blocks and their uses	
	3e	Select suitable type of material for given use.	3.5	Plywood, particle board, Veneers, laminated board and their uses. Types of glass: soda lime glass, lead glass and borosilicate glass and their uses. Ferrous and non-ferrous metals and their uses.	

UNIT IV: Special Construction Materials	4a	Suggest water proofing, termite proofing, thermal and sound insulation materials under given situation	4.1	Water proofing, Termite proofing, Thermal and sound insulating materials- Their types and suitability in construction works.	CO4
	4b	Identify relevant fibres for given uses in construction works	4.2	Fibres - Types -Jute, Plastic Asbestos Fibres , Steel fibres (only uses)	
	4c	Select the features of the given type of geo--polymer cement	4.3	Geo-polymer cement: Geo-cement: properties, uses and applications.	
	4d	Select a type of wall cladding under given situation	4.4	Wall claddings -Materials and uses	
UNIT V: Finishing Materials	5a	Suggest the mortar and its relevant proportion for the given construction work	5.1	Lime Mortar, Cement Mortar. Special Mortars and their uses as plastering materials, binding materials, Premix mortar.	CO5
	5b	Select the relevant type of POP board for given type of work	5.2	Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and usesTrusses – their types and use. Roof coverings.	
	5c	Select the relevant type of paint or finishing material to be used under the given situation.	5.3	Paints-Oil paints. Distempers and Varnishes with their uses (situations where used).	
UNIT VI: Processed construction Materials	6a	Identify the properties and uses of the given industrial wastes in construction .	6.1	Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses	CO6
	6b	Identify the properties and uses of the given agro wastes in construction.	6.2	Agro waste materials - Rice husk, Bagasse, Coir fibres and their uses	
	6c	Select the relevant processed construction material for the given situation with justification.	6.3	Special processed construction materials Geo-synthetics, Ferrocrete. Artificial timber. Crushed sand and their uses	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)	Hours	Aligned COs

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Identify various construction activities in various fields of Civil Engineering.

2. Prepare list of construction materials used in building construction

3. Prepare Library / internet based micro-project of the course contents.

4. Collect samples of various materials used in construction.

5. Prepare a report on suitability of various construction materials in construction of structures.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Overview of Construction Material	5	C	02	04	00	6
			O	0	0	0	0
2	Natural Construction Material	8	C	02	06	02	10
			O	0	0	0	0
3	Artificial Construction materials	10	C	06	08	04	18
			O	0	0	0	0
4	Special Construction Materials	8	C	04	04	04	12
			O	0	0	0	0
5	Finishing Materials	8	C	02	08	04	14
			O	0	0	0	0
6	Processed construction Materials	6	C	02	06	02	10
			O	00	0	00	0
Total		45	C	18	36	16	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q 1 to Q 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35	
	2A2	3R2	3R2	3R2	3U2	3U2	3U2		
	3U2	3A2	3A2	4R2	4R2	4U2	4U2		
	4A2	4A2	5R2	5U2	5U2	5U2	5U2		
	5A2	5A2	6R2	6U2	6U2	6U2	6A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Topic	5
2	Performance	10
3	Report Writing	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	2	-	-	-	-
CO2	3	-	-	3	2		-	3	3
CO3	3	-	-	3	2	2	-	3	3
CO4	3	-	-	3	2	2	-	3	3
CO5	3	-	-	3	2	2	-	3	3
CO6	3	-	-	3	3	2	-	3	3

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Construction Materials	Ghose. D. N., Tata McGraw Hill, New Delhi. 2014	9780074516475
2	Building Materials	Varghese, P.C., PHI learning, New Delhi. 2014	8120328455
3	Engineering Materials	Rangwala. S.C., Charotar Publisher. Ahmedabad, 2015	9789385039171
4	Civil Engineering Materials	Somayaji, Shan, Pearson Education, New Delhi, 2015	9788131766316
5	Engineering Materials	Rajput R.K., S. Chand and Co., New Delhi, 2015	8121919606
6	Engineering Materials	Sharma, PHI Learning, New Delhi. 2015	812032448X
7	Building Materials	Duggal S. K., New International New Delhi, 2014	S1.22414354

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2. https://civiconcepts.com/blog/building-construction-process-stepshttps://civiljungle.com/building-construction/,
3. https://theconstructor.org/construction/project/basics-building-construction/25260/
4. https://civiltoday.com/construction/wall/244-masonry-wall-definition-types, accessed on
5. https://mccoymart.com/post/types-of-doors-and-windows/
6. https://civilengineeringx.com/super-structures/doors-and-windows/
7. concepts.com/blog/types-of-stairs,
8. https://www.youtube.com/watch?v=K1s0y2v6gOs,
9. https://www.youtube.com/watch?v=nV3z-GERn3Y,
10. https://www.youtube.com/watch?v=e_2ZDfWLtN4

XVI List of Major Equipment/Machineries with Specification:

1. ---

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.A.W.Pawde	Head, Civil Engineering	Govt. Polytechnic, Nagpur
2	Dr.D.N.Kongre	Lecturer, Civil Engineering	Govt. Polytechnic, Nagpur
3	Mr.V.B.Dhait	Lecturer, Civil Engineering	Govt. Polytechnic, Nagpur
4	Mrs.N.K.Deshmukh	Lecturer, Civil Engineering	Govt. Polytechnic, Nagpur
5	Er. G. B. Takey	EE,Vigilance & Quality Control	J. L. Priyadarshini College of Engg, Nagpur
6	Dr. Abhay Shende	Principal	J. L. Priyadarshini College
7	Dr. V. G. Kondekar	Head, Civil Engineering	Govt. Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE102H
Course Title	:	Building Construction

I Rationale:

Construction material is the key element in the construction project. Construction of building is one of the most important civil engineering structures . If the students are interested in pursuing a career in construction in globe, building construction course is an ideal choice. It offers the chance to learn and practise various building techniques, how to operate safely within a construction site, plan and organise construction operations, and more. This course usually includes a significant practical component, to ensure that civil engineers are fully qualified and prepared to work in the construction industry upon completion. Whether civil engineers are just starting out in their career or looking to expand their skills and knowledge, this course can help you achieve their goals.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply safe building construction practices.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** different components of building.

CO2: **Select** suitable type of foundation for site conditions and building construction.

CO3: **Select** suitable type of masonry for construction of building walls.

CO4: **Propose** relevant types of doors & windows for different types of buildings.

CO5: **Select** relevant material for flooring and roofing of building.

CO6: **Propose** relevant material for finishing and form work.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Building Components	1a	Identify given components of building.	1.1	Building: Definition, Types as per NBC, Components, Sub-structure, Super Structure.	CO1
	1b	Differentiate between load bearing and Framed structure on given points.	1.2	Load bearing, framed structure and composite structure. Their advantages and differentiation.	
	1c	Justify given types of soil exploration method.	1.3	Site inspection and exploration.	
II: Foundation	2a	Justify given methods.	2.1	Excavation for foundation; Timbering and Strutting its types; purpose of foundation.	CO2
	2b	identify various types of shallow foundations.	2.2	Types of foundation – Shallow foundation its types; Wall footing, column footing, combined column footing, strap footing, raft foundation.	

UNIT	2c	Select suitable types of deep foundations for Select suitable types of deep foundations for given site conditions.	2.3	Deep foundation its types; Pile foundation its types; well foundation its types; Under reamed pile foundation, Cofferdams its purpose & types.	
UNIT III: Masonry	3a	Select suitable types of stone masonry in given condition.	3.1	Stone Masonry : Technical terms; Classification – Rubble and Ashlar masonry; its construction and use; important points to be observed during its construction.	CO3
	3b	Select suitable types of Brick masonry in given condition.	3.2	Brick Masonry : Technical terms; Types of bonds their construction and use; important points to be observed during its construction.	
	3c	Differentiate between masonries with given points.	3.3	Quality of masonry work – quality of stones, bricks and mortar; Differentiation between stone and brick masonry; Tools and plants used.	
ors and Windows	4a	Select suitable location for doors with their sizes and locations in given circumstances.	4.1	Horizontal Communication – Doors: Definition, components, purpose; materials used, their sizes as per BIS; Types of Doors with their location and uses; fixtures and fastenings.	CO4
	4b	Select suitable location for windows with their sizes and locations in given circumstances.	4.2	Windows: Definition, components, purpose; materials used, their sizes as per BIS; Types of windows with their location and uses.	

UNIT IV: Do	4c	Select suitable materials for ventilators, Sill, Lintel and Arch with their locations.	4.3	Ventilators - Definition, components, purpose; materials used, their sizes, locations; Ventilators - Definition, components, purpose; materials used, their sizes, locations; Sills, Lintels and Arches – Definitions, components, locations, purposes, material used.	
UNIT V: Floors and Stairs	5a	Select suitable type of flooring for the given situation.	5.1	Floors – Ground floor, mezzanine floor, upper floors, terrace floor, its purposes and locations. Floor finish – Various stone floorings, tiled floorings, IPS flooring, modern materials used as flooring; Skirting and Dado; Construction of floors.	CO5
	5b	Identify the given types of roofs and trusses.	5.2	Roofs – Definition; Types: flat and pitched roof; technical terms in roofs; various types of pitched roof with their purpose and locations. Trusses – their types and use. Roof coverings.	
	5c	Select relevant type of stair for given situation	5.3	Stairs – Definitions, components, types with their use and location; Requirements of good stair; Design of stair.	
k	6a	Select the relevant type of internal and external plastering in the given situation.	6.1	Plastering – Definition, purpose, mortar used; Types of internal and exterior plastering; Process of plastering. Mortars used in plastering.	

UNIT VI: Finishing Wor	6b	Identify the relevant type of material for pointing and painting according to need and given situation.	6.2	Pointing - Definition, purpose, mortar used; Types of pointing and their use. Painting - Definition, purpose; Types of paints and their use. Process of painting on old and new surface.	CO6
	6c	Choose the appropriate material for scaffolding and formwork for given work.	6.3	Scaffolding – Definition, purpose, technical terms, types, modern scaffolds. Formwork - Definition, purpose, technical terms, types, modern formwork.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify different components of building by observing existing building in the institute campus.	02#	CO1
II	2	Prepare the foundation plan from the given drawing to mark layout of load bearing structure on ground. (Part-1)	02#	CO2
II	3	Carryout marking of layout of load bearing structure on ground. (Part-2)	02#	CO2
II	4	Prepare the foundation plan from the given drawing to mark layout of framed structure on ground. (Part-1)	02#	CO2
II	5	Carryout marking of layout of framed structure on ground. (Part-2)	02#	CO2
II	6	Draw Labelled Sketches for Section of column footing on A3 Size Sheet.	02#	CO2
III	7	Prepare various types of closers in laboratory. (Group of 10 students).	02#	CO3
III	8	Draw labelled sketches of alternate courses for one brick thick wall corner in English and Flemish bond on A3 size sheet. (Part-1)	02#	CO3
III	9	Develop English and Flemish bond for one brick thick wall corner by using models of bricks. (Minimum 3 courses)(Part-2)	02#	CO3
III	10	Identify different components of stone masonry by observing existing building in the city/ town and prepare a report.	02#	CO3
IV	11	Identify different types of doors and windows by observing existing building in your campus and prepare a report.	02#	CO4
IV	12	Draw Plan, elevation and section of panelled door and glazed window on A3SizeSheet.	02#	CO4
V	13	Identify various types of flooring in your campus and prepare report.	2	CO5
V	14	Identify various types of stairs in your campus and prepare report and prepare layouts of identified stairs.	02#	CO5
VI	15	Visit to a site to record the observation of plastering work and prepare a report.	4	CO6
VI	16	Draw sketches of formwork for concrete works on A3 size sheet.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Undertake a market survey of local dealers for modern tools and plant used in building construction.
2. Organize a visit to Construction sites of different types such as simple residential buildings, malls, multistoried buildings to identify various components and its process.
3. Prepare Library / internet based micro-project of the course contents
4. Prepare a model of various bonds in brick and stone masonry.
5. Prepare a model of various types of stairs showing its application.
6. Collect various types of modern materials and their uses.
7. Prepare a report on quality of construction of building.
8. Prepare model of various types of door and windows with their applications.
9. Design staircase for given data.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Building Components	4	C	02	04	00	6
			O	0	04	0	4
2	Foundation	8	C	02	08	04	14
			O	0	04	04	8
3	Masonry	9	C	02	08	04	14
			O	0	04	04	8
4	Doors and Windows	8	C	02	04	06	12
			O	02	06	0	8
5	Floors and Stairs	8	C	0	06	06	12
			O	0	06	0	6
6	Finishing Work	8	C	02	06	04	12
			O	02	0	04	6
Total		45	C	10	36	24	70
			O	4	24	12	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	6R2	4R2	6R2	5	7
2	1U4	2U4	2R4	1U4	2U4			3	5
3	2A4	3U4	3U4	2A4	3U4			3	5
4	3A4	4U4	6A4	3A4	6A4			3	5
5	4A6	5A6	4U6					2	3
6	5A6	6U6	5U6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of topic from faculty	5
2	Performance on given topic	10
3	Calculation, Result, Drawing Graphs, Reports (if any)	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-
CO2	3	-	-	3	-	3	-	3	-
CO3	3	-	-	3	3	3	-	3	-
CO4	3	-	-	3	3	3	-	3	-
CO5	3	-	-	3	3	3	-	3	-
CO6	3	-	-	3	3	3	-	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Building construction	Sushil kumar, Standard Publication,2010	19788180141683
2	A text book of building construction	S. P. Arora and S. P. Bindra Dhanpat Publication, Revised 2018	8189928805
3	Building construction	B. C. Punmia, Ashok kumar Jain Arun kumar Jain , Laxmi	9788131804285
4	Building construction	S. K. Sharma, S Chand & Company pvt.Ltd.,2013	9788121904797
5	Indian Practical Civil Engineers' Handbook	P.N. Khanna, UBS Publishers' Distributors Ltd	0274198339
6	National Building Code of India 2016 (NBC 2016)	Bureau of Indian Standards	Bureau of Indian Standards, New Delhi

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1. https://www.aboutcivil.org/building-construction-and-design.html
2. https://civiconcepts.com/blog/building-construction-process-stepshttps://civiljungle.com/building-construction/,
3. https://theconstructor.org/construction/project/basics-building-construction/25260/
4. https://civiltoday.com/construction/wall/244-masonry-wall-definition-types
5. https://mccoymart.com/post/types-of-doors-and-windows/
6. https://civilengineeringx.com/super-structures/doors-and-windows/concepts.com/blog/types-of-stairs,
7. https://www.youtube.com/watch?v=K1s0y2v6gOs,
8. https://www.youtube.com/watch?v=nV3z-GERn3Y,
9. https://www.youtube.com/watch?v=e_2ZDfWLtN4

XVI List of Major Equipment/Machineries with Specification:

1. Measuring Tape (3 meter, 15meter, 30meter)
2. Raw material such as bricks of standard size 230 mm x 115 mm x 75 mm.
3. Trowels (Brick, Buttering, Pointing), triangular, ranging in size up to about 11 inches (279.40 mm) long and from 101.6 mm to 203.2 mm wide i.e. (4 to 8 inches wide).
4. Portable Hammer, Spade, Pans (ghamela), Thread, lime.
5. Square, mason's level, and straightedge 28.57 mm to 38. 10 mm and the middle 4 portion of the top edge from 152.40 mm to 254 mm wide
6. Levels and mason's line, brushes.
7. String Level/Water tube, Plumb bob. Right Angle
8. Components of wood work- different types of Hinges, tower bolts, brackets etc.
9. Models of buildings and its components.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.D. K. Parbat	Head, Civil Engineering	Govt. Polytechnic, Nagpur
2	Mr. R. M. Walke	Lecturer, Civil Engineering	Govt. Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer, Civil Engineering	Govt. Polytechnic, Nagpur
4	Er. G. B. Takey	EE,Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur
6	Dr. V. G. Kondekar	Head, Civil Engineering	Govt. Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/AE/CM/IT/AIML/MC/PK/MT/TX/TR
Course Category	:	AEC
Course Code	:	EN151H
Course Title	:	Business Communication

I Rationale:

Professional Communication is essential for smooth and efficient functioning of any industry or business. The drafting skills and application of business communication principles are essential for engineering professionals. It plays a vital role to help professionals instruct, guide and motivate peers/ subordinates to achieve desired goals at work place. Strong Communication skills contribute to career growth and opportunities. This course focuses to enrich the professional communication skills for effective presentation both in written and oral forms at workplace.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Communicate technical information clearly and effectively.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Communicate** effectively(oral/written) in formal situations.

CO2: **Develop** and exhibit language skills in professional interactions.

CO3: **Write** job application with resume/CV and compose effective e-mails.

CO4: **Draft** official letters.

CO5: **Draft** business correspondence with minimal errors.

CO6: **Organize** formal meetings and maintain official records.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Types of communication	1a	-	1.1	Professional communication - Definition, importance, relevance.	CO1
	1b	-	1.2	Principles/7 C's of Professional communication: Clarity, Conciseness, correctness, coherent, concrete, courteous and complete.	
	1c	-	1.3	Types of communication- Verbal: Written - oral, formal - informal, internal –external, vertical – upward, downward, horizontal, diagonal and Non-verbal.	
	1d	-	1.4	Non-verbal communication – body language: gestures, postures, eye contact, facial expression. Non-verbal codes - dress and appearance, colors, sounds, signs, proxemics, chromatics, artifacts.	

UNIT II: Communication in Practice	2a	-	2.1	Receptive Productive Skills: Receptive language skills- Listening and reading, importance, Difference between listening & Hearing, Types of listening a) Active listening b) Passive listening c) Selective listening, tips to improve receptive skills, qualities of a good listener, scanning & skimming a text, tips to improve receptive skills.	CO2
	2b	-	2.2	Productive language skills- speaking and writing, importance, how receptive skills help to develop productive skills, tips to improve productive skills.	
	2c	-	2.3	Techniques of Note taking, Types of notes taking-Mind Mapping, Flowcharts.	
UNIT III: Formal Drafting	3a	-	3.1	Drafting Letters: Importance of formal drafting, parameters of formal drafting.	CO3
	3b	-	3.2	Job application -Format Resume writing- Differentiate between CV, Bio data and Resume. Leave application: format, use of appropriate language.	
UNIT IV:	4a	-	4.1	Official Drafting: Notice & Circular - difference between notice & circular, purpose of drafting, tips to draft in precise language.	CO4
	4b	-	4.2	Email: Email etiquettes, drafting- email with proper salutation, subject line, cc, bcc, attachments	

UNIT V: Business letters	5a	-	5.1	Business Letters: Enquiry letter and Order letter: format, use of technical language, reply to enquiry and order letter.	CO5
	5b	-	5.2	Complaint letter: format, use of polite language, reply to complaint letter.	
UNIT VI: Minutes & Report Writing	6a	-	6.1	Agenda, Minutes & Report Writing: Preparing checklist to organize official meeting, Drafting agenda: format, sequence of activities.	CO6
	6b	-	6.2	Drafting minutes of meeting: Importance, format, identifying important happenings.	
	6c	-	6.3	Report writing: Investigation /Survey report: format, purpose, techniques.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Enlist advantages and limitations of written/oral communication. Prepare a case study on limitations of written/oral communication and suggest remedies for the same.	2#	CO1
I	2	Undertake a role play/group discussion using suitable body language and non-verbal codes of communication.	2	CO1
I	3	Give a presentation / Seminar using 7 C's of Communication.	2#	CO1
II	4	Listen to motivational audios in the language lab and make notes of it.	2	CO2
II	5	Draw flow chart and mind map for any topic related to the curriculum.	2#	CO2
III	6	Draft a leave application letter to an authority following the rules of drafting.	2#	CO3
III	7	Prepare a Job Application in response to an advertisement following the steps of official drafting.	2#	CO3
III	8	Prepare a Resume highlighting the academic and professional details of the individual.	2#	CO3
IV	9	Draft notices for the organization and events mentioned. (04-topics)	2#	CO4
IV	10	Draft Circulars for the organization and events mentioned (04-topics).	2	CO4
IV	11	Type formal E-mails using email etiquette (04-topics).	2#	CO4
V	12	Draft an Enquiry and order letter for the organization as a designated authority.	2#	CO5
V	13	Draft a complaint letter for various situation (02-topics).	2#	CO5
VI	14	Participate in Group Discussion.	2#	CO6
VI	15	Face mock interview arranged by your teacher.	2#	CO6
VI	16	Write a detailed report on investigation/survey.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Types of communication	8	C	-	-	-	0
			O	-	-	-	0
2	Communication in Practice	6	C	-	-	-	0
			O	-	-	-	0
3	Formal Drafting	4	C	-	-	-	0
			O	-	-	-	0
4		4	C	-	-	-	0
			O	-	-	-	0
5	Business letters	4	C	-	-	-	0
			O	-	-	-	0
6	Minutes & Report Writing	4	C	-	-	-	0
			O	-	-	-	0
Total		30	C	0	0	0	0
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA): -NA-

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	5
2	Overall presentation of given assignment	10
3	Viva Voce	5
4	Activity	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA): -NA-

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	1	-	3	-	-
CO4	-	-	-	-	-	1	3	-	-
CO5	-	-	-	-	-	1	3	-	-
CO6	-	-	-	-	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Professional Communication Skills	S.R.Pravin, S.Chand Publications.	81-219-2092-02
2	Developing Communication Skills	Macmillan Publications, Revised Edition, 2011	0333929195
3	Business Communication and Soft Skills.	G.S.R.K Babu Rao, Himalaya Publication, First Edition, 2009	978-81-8488-596-5
4	Secret of Face-to-Face Communication.	Peter Urs, Bendar, Macmillan Publication	0333937139
5	Technical Communication Principles and Practices	Meenakshi Raman, Prakash Singh, Oxford University Press	0-19-567695-5
6	Effective English Communication	Krishna Mohan, Raman Tata Mc Graw Hills	13978-0-19-566804-9
7	Modern Commercial Correspondence	R.S.Pillai, Bhagwati, S.Chand & Co.	812190519-2

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1. https://en.wikipedia.org/wiki/Business_communication, accessed on 29th July 2021
2. https://www.indeed.com/career-advice/career-development/types-of-business-letters , accessed on 29th July 2021
3. https://in.indeed.com/career-advice/resumes-cover-letters/communication-skills , accessed on 29th July 2021
4. https://www.youtube.com/watch?v=jaxgeXPgAz0 , accessed on 29th July 2021

XVI List of Major Equipment/Machineries with Specification:

1. Desktop Computers latest version
2. Headphones
3. Language lab software

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M. M. Machale	Lecturer in English	Government Polytechnic, Nagpur
2	Dr. Rupali Londhe	Lecturer in English	Government Polytechnic, Nagpur
3	Mr. Nitin Pote	Lecturer in English	Government Polytechnic, [illegible]
4	Mr. Ravindra Suryawanshi	Lecturer in English	NIT Polytechnic, Nagpur
5	Mr. Nitin Pathak	Lecturer in English	Kamptee Polytechnic, Nagpur

(Mr. P. T. Khobragade)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Secretary PBOS, COMMON

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	SEC
Course Code	:	ME152H
Course Title	:	Engineering Graphics (Civil)

I Rationale:

Engineering graphics is a non-verbal and graphical language to communicate ideas, instructions and facts with each other clearly and without ambiguity while carrying out engineering jobs on the sites, shop floor etc. It describes the fundamentals, facts, concepts, principles and techniques of Engineering Graphics. The course illustrates techniques of drawing in an engineering field. It helps to develop the idea of visualizing the actual object or part on the basis of drawings and blue prints. This course is useful in developing drafting and sketching skills of the student. This preliminary course aims at building a foundation for the further course in drawing and other allied courses.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Prepare engineering drawings using prevailing drawing standards and instruments.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** and construct appropriate drawing scales and use drawing instruments & Apply IS SP-46 2011 for engineering drawing.

CO2: **Draw** various engineering curves.

CO3: **Covert** isometric projections into orthographic projections.

CO4: **Visualize** three dimensional objects and draw isometric projections.

CO5: **Apply** knowledge of projections of points and solve the problems on projection of straight lines.

CO6: **Draw** freehand sketches of a civil engineering elements.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	4	-	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	50	20	50	20	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Principles of Drawing	1a	Draw the scale as per IS SP-46 from given data.	1.1	Use of different drawing instruments and equipment, Types of letters and numbers (single stroke vertical) and Conventions of lines, Dimensioning technique as per IS SP- 46. Scales (reduced, enlarged and full size)-Plain scale, diagonal scale.	CO1
	1b	Redraw the given geometrical figure as per IS SP - 46.	1.2	Redrawing of geometrical figures.	
: Engineering Curves	2a	Draw conic sections by specified method from given data.	2.1	Drawing of Conic Sections: Draw an ellipse by: Arcs of circles method; Rectangle method; Concentric circles method; Draw parabola by: Directrix-focus method; Rectangle method; Draw hyperbola by: Directrix–focus method; Passing through a given point with reference to given asymptotes.	CO2

UNIT II	2b	Draw involute, and know their applications. Draw cycloidal curve, spiral and helix from given data and know their applications.	2.2	Draw involute of circle and polygon of maximum six sides. Drawing of cycloid, epi-cycloid and hypo-cycloid. Draw Archimedean spiral and Helix.	
UNIT III: Orthographic Projections	3a	Draw Orthographic projection methods.	3.1	Introduction to orthographic projections, First angle and Third angle method of projections.	CO3
	3b	Visualize, interpret and draw orthographic views from given pictorial views.	3.2	Conversion of simple pictorial view (object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces.) into orthographic views by First angle and third angle projection method.	
UNIT IV: Isometric Projections	4a	Draw isometric scale.	4.1	Introduction to isometric scales, isometric views/drawings and isometric projections.	CO4
	4b	Visualize, interpret and draw Isometric views/ projections from the given orthographic view.	4.2	Isometric views/ projections of simple & cylindrical object (plane surfaces, slanting surfaces, and Rectangular, V, Trapezoidal slots).	
UNIT V: Projection of Straight Line	5a	Draw projection of Lines from the given data.	5.1	Projections of straight lines inclined to one reference plane and parallel to the other–limited to both ends in first quadrant.	CO5
UNIT VI: Free Hand Sketches/Conventional Representation	6a	Draw relevent lines for given situations.	6.1	Lines used in building / civil engineering drawings- mhidden, break, dimension, continious.	CO6
	6b	Identify and draw symbols for relevent construction materials for given situations.	6.2	Symbols of materials used in construction such as brick/ stone masonary, metal, rubble soling, mortar, PCC, RCC, RSJ, wood in section, glass in elevetion and section, symbols of sanitary and electrical installations.	
	6c	Draw relevent graphical symbols for doors and windows.	6.3	Graphical symbols for doors and windows openings.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Draw lettering, numbers, conventions of lines and figure fordimensioning techniques as per IS SP-46. (Practical Sketch book)	2	CO1
I	2	Draw plain scale and diagonal scale from given data. (Practical Sketch book)	2#	CO1
I	3	Redraw given geometrical constructions. (Practical Sketch book)	2#	CO1
I	4	Apply dimensioning technique as per IS SP-46: 2011 to redraw given geometrical figures. (Sheet No. 1)	2#	CO1
II	5	Draw Engineering Curves - Conic Section - Parabola, Ellipse and Hyperbola by given methods. (Practical Sketch book)	2#	CO2
II	6	Draw Engineering Curves - Involute of pentagon, and circle (Practical Sketch book)	2#	CO2
II	7	Draw Engineering Curves - Archimedian spial, and helix (Practical Sketch book)	2#	CO2
II	8	Draw given Conic Sections Engineering Curves (Sheet No. 2)	2#	CO2
II	9	Draw Engineering Curves - Cycloidal Curves and its corrolaries. (Practical Sketch book)	2#	CO2
II	10	Draw given Involute, Helix and Cycloidal curves. (Sheet No. 3)	2#	CO2
III	11	Draw Orthographic Projection using third angle method of projection from given pictorial view. (Practical Sketch book)	2	CO3
III	12	Draw Orthographic Projection using third angle method of projection of given pictorial view (Part I). (Sheet No. 4)	2#	CO3
III	13	Draw Orthographic Projection using third angle method of projection of given pictorial view (Part II). (Sheet No. 4)	2#	CO3
III	14	Draw Orthographic Projection using first angle method of projection of given pictorial view. (Practical Sketch book)	2#	CO3
III	15	Draw Orthographic Projection using first angle method of projection of given pictorial view (Part I). (Sheet No. 5)	2#	CO3

III	16	Draw Orthographic Projection using first angle method of projection of given pictorial view (Part II). (Sheet No. 5)	2#	CO3
IV	17	Draw Isometric View of given orthographic view with plane surfaces & with cylindrical, slot, slanting surfaces . (Practical Sketch book)	2	CO4
IV	18	Draw Isometric View of given orthographic view with plane surfaces & with cylindrical, slot, slanting surfaces (Part I). (Sheet No 6)	2#	CO4
IV	19	Draw Isometric View of given orthographic view with plane surfaces & with cylindrical, slot, slanting surfaces (Part II). (Sheet No 6)	2#	CO4
IV	20	Draw Isometric Projection of given orthographic view with plane surfaces & with cylindrical, slot, slanting surfaces. (Practical Sketch book)	2	CO4
IV	21	Draw Isometric Projection of given orthographic view with plane surfaces & with cylindrical, slot, slanting surfaces (Part I). (Sheet No. 7)	2#	CO4
IV	22	Draw Isometric Projection of given orthographic view with plane surfaces & with cylindrical, slot, slanting surfaces (Part II). (Sheet No. 7)	2#	CO4
V	23	Draw Projections of straight lines using first angle method of projection (line inclined to one reference plane and parallel to the other–limited to both ends in first quadrant). (Practical Sketchbook)	2	CO5
V	24	Draw Projections of straight lines using first angle method of projection (line inclined to one reference plane and parallel to the other–limited to both ends in first quadrant) (Part I). (Sheet No. 8)	2#	CO5
V	25	Draw Projections of straight lines using first angle method of projection (line inclined to one reference plane and parallel to the other–limited to both ends in first quadrant) (Part II). (Sheet No. 8)	2	CO5

V	26	Draw Projections of straight lines using first angle method of projection (line inclined to one reference plane and parallel to the other–limited to both ends in first quadrant) (Part III). (Sheet No. 8)	2#	CO5
VI	27	Draw Free Hand Sketches of lines used in building / civil engineering drawing- hidden, break, dimension, continioous. (Practical Sketch book)	2#	CO6
VI	28	Draw Free Hand Sketches of symbols of materials used in construction such as brick/ stone masonary, metal, rubble soling, mortar, PCC, RCC, RSJ, wood in section, glass in elevetion and section. (Practical Sketch book)	2#	CO6
VI	29	Draw symbols of sanitary and electrical installations. (Practical Sketch book)	2#	CO6
VI	30	Draw free hand skeches of door and window openings. (Practical Sketch book)	2#	CO6

Note: # Compulsory. Use A2 Size drawing Sheet and A3 size Sketch Book.

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Principles of Drawing	4	C	0	0	0	0
			O	0	0	0	0
2	Engineering Curves	4	C	0	0	0	0
			O	0	0	0	0
3	Orthographic Projections	7	C	0	0	0	0
			O	0	0	0	0
4	Isometric Projections	7	C	0	0	0	0
			O	0	0	0	0
5	Projection of Straight Line	4	C	0	0	0	0
			O	0	0	0	0
6	Free Hand Sketches/Conventional Representation	4	C	0	0	0	0
			O	0	0	0	0
Total		30	C	0	0	0	0
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

-----NA-----

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Neatness , cleanliness and line work on drawing sheet	10
2	Creation of given drawing with proper dimensioning	20
3	In time submission	10
4	Viva Voce	10
	TOTAL	50

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	-	-	-	3	2	-	-
CO2	3	-	-	-	-	3	-	-	-
CO3	3	1	-	-	-	3	2	-	-
CO4	3	-	-	-	-	3	-	-	-
CO5	3	-	-	-	-	3	--	-	-
CO6	3	-	-	-	-	3	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Engineering Drawing Practice For Schools and Colleges IS:SP-46	Bureau of Indian Standards, Third Reprint, October 1998	10: 81-7061-091-2
2	Engineering Drawing	N.D.Bhatt, Charotar Publishing House, 53rd Edition, 2019	13: 9789380358963
3	Geometrical and Machine Drawing	N.D.Bhatt & V.M Panchal, Charotar Publishing House, 20th Edition, 2014	13: 9789380358895
4	Engineering Drawing	D.A. Jolhe, Tata McGraw-Hill Edu. 2010	13: 978-0-07-064837-1
5	Engineering Drawing	R.K.Dhawan, S.Chand & co.	10: 81-219-1431-0
6	Engineering Drawing	P.J Shaha, S.Chand & Co. 2013	10: 8121941822

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1. https://www.youtube.com/watch?v=ANEvQyt3PnU accessed on 30 June 2021.
2. https://www.youtube.com/watch?v=-W7tH49dBLw accessed on 30 June 2021.
3. https://www.youtube.com/watch?v=FXP3tKedM5g accessed on 30 June 2021.
4. https://www.youtube.com/watch?v=j5nwO JwVv4&list=PLDN15nk5uLiBpnIOK5r3KXdfFOVzGHJSt accessed on 30 June
5. https://www.youtube.com/watch?v=77ufJXvXUk4&list=PLIhUrsYr8yHxVky7bfrnbRcdXcHjT_K83&index=2(Iso)accessed on 30 June 2021.
6. https://www.youtube.com/watch?v=Jzr5PTbvkVI&list=PL1xA-ZWMKpOMt3ew5vcn3keBxlqHKtlgaccessed on 30 June 2021.

XVI List of Major Equipment/Machineries with Specification:

1. Drawing Board for Half-Imperial size Drawing Sheet
2. Drafting Machine or Mini-Drafter of good quality
3. All good quality Drawing Instruments
4. Large size Scale, 30-60 & 45-45 Set-Squares
5. French Curve

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. S. S. Baraskar	I/C HOD, Mechanical Engineering	Government Polytechnic, Nagpur
2	Prof. N. J. Burbure	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
3	Prof. R. S. Khobragade	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
4	Mr. S. P. Wakhare	Manager	Mahindra & Mahindra Ltd., Mumbai
5	Prof. G. F. Potbhare	Principal	NIT Polytechnic, Nagpur
6	Prof. G. H. Dahole	I/C HOD, Mechanical Engineering	Government Polytechnic, Gondia
7	Dr. B. R. Ambade	Lecturer in ivil Engineering	Government Polytechnic, Nagpur

(Dr. S. S. Baraskar)
HOD & Chairman PBOS, ME

(Dr. G. V. Gotmare)
Member Sectretary PBOS, ME

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/MT/PK/AE/TR/TX/MK/AI
Course Category	:	VEC
Course Code	:	VE152H
Course Title	:	Advance Personality Development

I Rationale:

This course equips students with essential life skills, focusing on well-being, leadership, interpersonal relationships, and citizenship. By integrating ancient wisdom, practical financial literacy, and teamwork skills, students develop a balanced and responsible outlook, supporting both professional success and personal fulfillment. This course aligns with holistic development goals in engineering education, fostering adaptability and resilience for real-world challenges.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Demonstrate resilience, teamwork, integrity, and financial literacy in professional and personal settings.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Enhance** personal well-being by setting goals, managing stress, avoiding addictions, and fostering a positive environment.

CO2: **Develop** effective leadership skills by embracing humility and applying mentor-guided solutions to daily challenges.

CO3: **Enhance** interpersonal relationships by practicing forgiveness in both personal and professional settings.

CO4: **Apply** ancient wisdom to effectively address and navigate modern-day challenges.

CO5: **Foster** responsible citizenship by cultivating values of integrity, loyalty, sincerity, and punctuality for national progress.

CO6: **Build** teamwork skills and financial literacy to achieve stability and harmony in professional and personal life.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	2	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	25	10

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
UNIT I: Remaking Yourself	1	**Begin with the End in Mind:** Visualize future goals and structure lives through smart goals to give direction to achieve desired outcomes.	2#	CO1
	2	**Being Addiction-Free:** Explore the detrimental effects of addictions on one's health, personal life, and family life and learn how to take control of life by becoming addiction free.	2#	CO1
	3	**Stress Management:** Cope with current and future causes of stress.	2#	CO1
	4	**Better Health Better Future:** Maintain good health through regular exercise, healthy eating habits, and regular and sufficient sleep.	2#	CO1
	5	**Impact of Company:** Develop the ability to create a positive environment around yourself.	2#	CO1
UNIT II: Learning from Legends	6	**Leading Without Leading:** Explore a new approach to leadership, through humility.	2#	CO2
	7	**Words of Wisdom:** Gain practical insights by engaging with mentors to address real-life challenges faced in daily life.	2#	CO2

UNIT III: From House to Home	8	**Forgive & Forget:** Apply the knowledge of forgiveness in personal and professional life.	2#	CO3
UNIT IV: Facing Failures	9	**Timeless Wisdom for Daily Life:** Use ancient wisdom to solve modern-day challenges.	2#	CO4
UNIT V: My India My Pride	10	**Present Scenario:** Implement the transformation of India from a developing country into a developed country it is necessary to have a value-based citizen.	2#	CO5
	11	**An Ideal Citizen - 1:** Develop good values by exploring the values of responsibility and integrity to become value-based citizens.	2#	CO5
	12	**An Ideal Citizen - 2:** Develop values of loyalty, sincerity, and punctuality by trying to keep perfection in every small task and by looking at the bigger picture.	2#	CO5
UNIT VI: Soft Skills	13	**Teamwork & Harmony:** Learn the six steps of teamwork and harmony that are essential for students' professional and daily life.	2#	CO6
	14	**Financial Planning:** Develop a variety of practical financial skills to become financially stable throughout the future careers.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Perform Selfless Service - Seva: Apply previous lessons of seva, to analyse the case study of the Bhuj earthquake relief work or any other relief work.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Content Understanding	10
2	Readability	5
3	Completeness	5
4	Viva voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Originality of work	5
2	Organization and Writing	5
3	Use of Evidence	5
4	Viva voce	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	3	3	3	-	-
CO2	-	-	-	-	3	3	3	-	-
CO3	-	-	-	-	3	3	3	-	-
CO4	-	-	-	-	3	3	3	-	-
CO5	-	-	-	-	3	3	3	-	-
CO6	-	-	-	-	3	3	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Integrated Personality Development Course Workbook-2	IPDC Team, Swaminarayan Aksharpith, Shahibaug, Ahmedabad- 4, India, 2nd Edition 2021.	10: 8175267062 13: 978-8175267060
2	Wings of Fire: An Autobiography	A.P.J. Abdul Kalam, Arun Tiwari (Contributor), Universities Press, 67th Edition 2023	13: 978-817371466
3	The Wit & Wisdom of Ratan Tata	Ratan Tata, Hay House India, January 2016	10: 9789385827297 13: 978-9385827297
4	Chase Your Dreams	Sachin Tendulkar, Hachette India, October 2017	10: 9351951995 13: 978-9351951995

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1. Julian Treasure: 5 ways to listen better | TED Talk accessed on 7th July, 2023
2. Listening Statistics: 23 Facts You Need to Hear (creditdonkey.com) accessed on 7th July, 2023
3. Robert Waldinger: What makes a good life? Lessons from the longest study on happiness | TED Talk accessed on 7th July, 2023
4. The Story Behind the Selfless Love of Ahmedabad's Seva Cafe (thebetterindia.com) accessed on 7th July, 2023
5. What Are Soft Skills? Definition, Importance, and Examples (investopedia.com) accessed on 7th July, 2023
6. Welcome to Mystic India accessed on 7th July, 2023

XVI List of Major Equipment/Machineries with Specification:

1. Desktop Computer, Latest Configuration
2. DLP, Latest Configuration
3. Smart Classroom with internet connection

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M.B.Daigavane	Principal	Government Polytechnic, Nagpur
2	Mr. Y.K.Chandarana	HoD, Applied MechanicsEngineering	Government Polytechnic, Nagpur
3	Dr. G. K. Awari	HoD, Automobile Engineering	Government Polytechnic, Nagpur
4	Dr. G.V. Gotmare	I/C, Curriculum Development Cell	Government Polytechnic, Nagpur
5	Dr. Megha Machale (Bhelande)	Lecturer in English	Government Polytechnic, Nagpur

(Dr. G.V.Gotmare)
HOD & Chairman PBOS, COMMON

(Dr. G.V.Gotmare)
Member Secretary PBOS, COMMON

Exit Course

I Year

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AE/MT/PK/TX/MK/AI
Course Category	:	INP
Course Code	:	IN151H
Course Title	:	Internship (Basic Skills)

I Rationale:

Internship (Basic Skill) is a four-week immersive program designed for first-year diploma students, offering hands-on experience in an industrial setting. Guided by the principles of the National Education Policy (NEP), the course aims to bridge academic learning with industry expectations by fostering practical knowledge, workplace skills, innovation, and professional discipline. Emphasizing skill acquisition and teamwork, students maintain daily activity diaries and submit a comprehensive post-internship report, reflecting on their learning journey. This course serves as an exit option after the second semester, fulfilling the requirements for the award of the "Certificate in Vocation."

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Work efficiently in an industrial environment.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Follow** safety guidelines, record measures, and act per industry standards.

CO2: **Collect** data from supervisors, analyze processes, and write concise reports.

CO3: **Follow** instructions, observe processes, and document daily industrial work clearly.

CO4: **Identify** and discuss problems, analyze causes, and suggest possible improvements.

CO5: **Compile** experiences, refine presentations, and prepare a professional internship report.

CO6: **Present** internship report and outcomes confidently, showing skills, technical knowledge, and clear communication.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	-	8	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	-	-	-	-	50	20

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)	Topics and Sub-topics	Aligned Cos

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Adhere to industrial safety practices by consulting the safety officer, recording safety procedures, noting the do's and don'ts, and following all instructions as per industry standards.	10#	CO1
II	2	Conduct an industrial process survey by gathering information through discussions with the assigned supervisor/officer, recording findings, and preparing a concise report.	10#	CO2
III	3	Work effectively in an industrial environment by following supervisor instructions, observing industrial processes, and maintaining a daily work diary.	60#	CO3
IV	4	Analyze industrial problems by discussing with supervisors and workers, identifying issues in systems or processes, and documenting the findings.	20#	CO4

V	5	Compile internship experiences into a clear, professional report and presentation; conduct practice sessions to enhance presentation skills and prepare documents as per faculty guidelines.	10#	CO5
VI	6	Present internship report and outcomes confidently to faculty and peers, demonstrating technical knowledge, communication skills, and clarity in conveying internship learnings.	10#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Choose entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO"s/ Government organizations/ Micro/ Small/ Medium enterprises to make ready for the industry.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Type of Industry	5
2	Work done and Feasibility of work	25
3	Report writing	10
4	Presentation Skills and Viva-Voce	10
	TOTAL	50

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	1	3	3	-	-
CO5	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Soft Skills: Enhancing Industrial Training and Education	Lokesh Choudhary, Mittal Publications, 2007	10: 8183242367 13: 9788183242363
2	Training Practice	Penny Hackett, McGraw-Hill Education, September 2003	10: 0852929803 13: 9780852929803
3	AICTE Internship Policy: Guidelines & Procedures	All India council of Technical Education New Delhi	-

XV e-References:

1. https://internship.aicte-india.org/ assessed on 23rd April 2024
2. https://www.coursera.org/articles/computer-science-internships assessed on 23rd April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Desktop computers
2. Laser Printer
3. DLP

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M.B.Daigavane	Principal	Government Polytechnic, Nagpur
2	Dr. M. V. Sarode	HoD, Computer Engineering and I/C Trainining & Placement Officer	Government Polytechnic, Nagpur
3	Dr. G. V. Gotmare	I/C Curricullum Development Cell	Government Polytechnic, Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

Semester

III

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	AM201H
Course Title	:	Mechanics of Structures

I Rationale:

This course equips students with essential skills in structural analysis and design. Students learn to evaluate material behavior under different loads, analyze shear forces and bending moments on beams, compute moment of inertia for bending stresses, determine columns' load-carrying capacity, and analyze truss forces. This holistic approach ensures students can design structurally sound, efficient systems, safety and reliability in engineering practice

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Conduct Material Testing and quality Control

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Determine** various material parameters under various load condition.

CO2: **Analyse** the effect of shear force and bending moments on beams.

CO3: **Compute** Moment of Inertia of different sections.

CO4: **Analyse** the Bending and Shear Stresses in beams under different loading condition

CO5: **Calculate** the load carrying capacity of column using empirical formulae.

CO6: **Analyse** the forces in members of truss using various methods

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Simple Stress, Strain and Elastic Constants	1a	Compute the values of given terms	1.1	Stress, strain, elasticity. Rigid, elastic and plastic bodies. Deformation of elastic body under various forces	CO1
	1b	Calculate Material Properties Under given load condition	1.2	Type of stresses-normal and tangential, normal tensile and compressive stresses, standard stress strain curve for mild steel bar under tension test, Hooke's law, elastic limit, modulus of elasticity, factor of safety, yield and working stresses	
	1c	Compute stresses and load shared by given composite sections subject to direct load	1.3	Stress and strain in composite sections under axial loading	
	1d	Calculate the change in dimensions and volume of the body subjected to uniaxial, biaxial and tri-axial loads/stresses of given materials	1.4	Longitudinal and Lateral strain, Poisson's ratio, biaxial and triaxial stresses, volumetric strain, change in volume, Bulk modulus	

UN	1e	Calculate design constants for given conditions	1.5	Shear stress and strain, modulus of rigidity, complementary shear stress and induced tension and compression due to it,Relation between modulus of elasticity, modulus of rigidity and bulk modulus	
UNIT II: Shear Force & Bending Moment	2a	Classify given terms related to beams and supports	2.1	Types of beams like simply Supported,Canilever, Overhang Beam, supports and loads.	CO2
	2b	Interpret with sketch of the given type of beam, load and end condition relevant to the actual field situation	2.2	Concept and definition of shear force and bending moment, relation between Shear Force and Bending moment , Sign Convention	
	2c	Draw Shear Force & Bending Moment Diagram for given Statically Determinate Beams	2.3	Shear force and bending moment diagram for simply supported, Cantilever and one sided over hanging beams subjected to vertical point loads and uniformly distributed loads only	
	2d	Calculate the shear force and bending moment for given beam and load conditions	2.4	Drawing Shear Force and Bending Moment Diagram, Location of point of Contra-flexure,Point of Contra shear,Maximum Bending Moment	
ent of Inertia	3a	Compute the values of given terms	3.1	Moment of Inertia of plane lamina, radius of gyration, parallel and perpendicular axes theorems, Moment of Inertia of rectangular, circular, semi-circular, Quarter Circle,triangular,Hollow recctangualrand Circular sections (Without Derivation)	

UNIT III: Mom	3b	Compute Moment of Inertia of given Symmetric or Asymmetric structural sections using given theorems	3.2	Moment of Inertia of symmetrical and Unsymmetrical I-section, channel section, T-section, angle section (Numericals on composite figures consisting of maximum 03 standard shapes)	CO3
	3c	Calculate Polar Moment of inertia of given sections	3.3	Polar Moment of Inertia of circular sections	
UNIT IV: Bending and Shear Stresses in Beams	4a	Illustrate given terms related to bending and bending stresses	4.1	Concept of pure bending, theory of simple bending,Assumption, neutral axis, Bending stresses and their nature	CO4
	4b	Calculate Bending and shear stresses at any location in the given beam	4.2	Flexural Equation,Bending stress distribution and Moment of resistance across goven cross section for canilever and simply supported beam s only.	
	4c	Determine the location of maximum and minimum bending and shear stress of given beam	4.3	Shear stress equation(witohut derivation) and meaning of term used in equation,Relation between maximum and average shear stress	
	4d	Draw the stress distribution diagram of given beam	4.4	Shear stress distribution for Rectangular, Hollow rectangular, Angle Sections, Channel section, I-Section, T sections and Compound sections. Simple problems based on it	
NIT V: Columns	5a	Illustrate given terms and Compute their values	5.1	Columns, Short column, long column, type of end conditions for Columns, Buckling of axially loaded columns	CO5
	5b	Illustrate given terms and compute their values	5.2	Effective length, radius of gyration, Slenderness ratio, Assumptions made in Euler's theory, Euler's buckling loads	

UN	5c	Determine the critical and safe loading on the column for given end conditions of column	5.3	Rankine's formula used for calculated crippling loads	
UNIT VI: Simple Plane Frames	6a	Cllassify given terms and frames	6.1	Introduction , Classification of frames and Assumptions in analysis of frames	CO6
	6b	Analyze the given truss by method of joint	6.2	Calculations of forces in members of truss using Method of joints	
	6c	Analyze the given truss by method of section	6.3	Calculations of forces in members of truss using Method of section	
	6d	Draw the Space and Vector Diagram and calculate the forces and their nature of given frame	6.4	Calculations of forces in members of truss using Graphical method Simply supported and Cantilever perfect frames with vertical & inclined loads	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Operate Universal Testing Machine for different types of test	2#	CO1
I	2	Measure the elongation of steel by using Extensometer	2	CO1
I	3	Operate Compression testing machine for compression test	2#	CO1
I	4	PerformTension test on HYSD/TOR steel as per IS 1786 (2008)	2#	CO1
I	5	Determine Water absorption of conventional and fly ash bricks	2	CO1
I	6	Determine Compressive strength of dry and wet bricks	2	CO1
I	7	Conduct Abrasion test on Flooring tiles (any one) e.g Mosaic tiles, Ceramic Tiles as per IS 13630(Part 7), Cement Tiles as per IS 5242	2#	CO1
I	8	Conduct Shear test on different metals such as MS (Mild steel), AL (Aluminium), BR (Brass) and CU (Copper) as per IS 5242	2#	CO2
II	9	Draw shear force and bending moment diagrams of different types of beams and loadings. (Six problems on – Three A2 size sheets.) Part-I	2#	CO2
II	10	Draw shear force and bending moment diagrams of different types of beams and loadings. (Six problems on – Three A2 size sheets.) Part-II	2#	CO2
IV	11	Conduct Flexural test on floor tiles IS-1237,IS13630 or roofing tiles as per IS2690	2#	CO4
IV	12	Conduct Flexure test on wooden beam of rectangular cross section as per IS 1708, IS 2408	2	CO4
VI	13	Determine the forces in the members of roof Truss	2	CO6
VI	14	Draw the space diagram and force diagram of simple plane frames and determine axial forces in its members (Four problems -Two Cantilever and two Simply supported on Two A2 size sheets) Part-I	2	CO6
VI	15	Draw the space diagram and force diagram of simple plane frames and determine axial forces in its members (Four problems -Two Cantilever and two Simply supported on Two A2 size sheets) Part-II	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect Different photographs indicating types of beam,Types of Support,Types of loads (RCC and Steel)
2. Prpare models of differents types of frames for different Spans
3. Prepare charts of maximum bending moment and shear force values in standard beams for different loading type
4. Draw & identify difference between bending Stress distribution diagram and Shear stress Distribution diagram for various sections
5. Prepare models representing different types of support and beams
6. Prepare a report on Trusses by Visiting any Site
7. Collect Sample from Construction site and Test in lab and prepare a report

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Simple Stress, Strain and Elastic Constants	10	C	06	04	06	16
			O	04	04	00	8
2	Shear Force & Bending Moment	8	C	02	04	06	12
			O	00	00	06	6
3	Moment of Inertia	6	C	00	04	06	10
			O	02	04	00	6
4	Bending and Shear Stresses in Beams	7	C	02	04	04	10
			O	02	00	04	6
5	Columns	6	C	02	04	04	10
			O	00	04	04	8
6	Simple Plane Frames	8	C	02	04	06	12
			O	00	00	06	6
Total		45	C	14	24	32	70
			O	8	12	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	4R2	5R2	6R2	3R2	4R2	5	7
2	1R4	1U4	2U4	1U4	1R4			3	5
3	3U4	4U4	5U4	3U4	4A4			3	5
4	6U4	4A4	5A4	5A4	5U4			3	5
5	1A6	2A6	2A6					2	3
6	3A6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Diagram, selection of equipment	5
2	Performance	5
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	10
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Topic	5
2	Report Content	10
3	Presentation/Report wrting	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	3	3	-	3	2	-
CO2	3	3	-	3	3	-	3		-
CO3	3	3	-	-	-	-	3	2	-
CO4	3	3	-	3	3	-	3	-	-
CO5	3	3	-	-	-	-	3	-	-
CO6	3	3	-	3	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Textbook of Strength of Materials	Dr. R.K. Bansal Publisher: Laxmi; Publications(P) Ltd. 5th edition, 2012	978-8131808146
2	Strength of Material	R.S Khurmi Publisher-Chand (S) & Co.Ltd	978-8121928229
3	Strength of Material	S. Ramamurtham, Dhanpat Rai Publishing Co	818743354X,9788187 433545
4	Mechanics of Structure Vol 1	S. B. Junnarkar and H. J. Shah, Publisher: Charotar Publishing House Pvt. Ltd, 2012	978-9380358659
5	Strength of Material	Sunil S. Deo, Nirali Prakashan,2013	978-9383073283
6	Strength of Material	D.P.Kothari, G.K.Awari, S.K.Bhadke New Age International Publishers	978-9388818209
7	Mechanics of Materials	Punmia B.C, Ashok Kumar Jain,Arun Kumar jain-Laxmi Publications-New Delhi 2017	978-8131806463

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1. https://youtu.be/67fSwIjYJ-E accessed on 08th April 2024
2. https://youtu.be/l20kF6fhScA accessed on 08th April 2024
3. https://youtu.be/InEpKlYBkvk accessed on 08th April 2024
4. https://www.youtube.com/watch?v=AkX6JqlWRqc&list=PLEYqyyrm-h accessed on 08th April 2024
5. https://www.youtube.com/watch?v=f2eGwNUopws accessed on 08th April 2024
6. https://www.youtube.com/watch?v=yvbA4mk36Kk accessed on 08th April 2024
7. https://skyciv.com/structural-software/beam-analysis-software accessed on 08th April 2024
8. https://www.youtube.com/watch?v=MFZ18Ed4HI8 accessed on 08th April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Universal Testing machine of capacity 400kN,600kN/1000kN with all attachments
2. Extensometer with least count 0.01mm, maximum extension 25 mm with single dial gauge
3. Compression testing machine of capacity 2000KN, analog /digital type
4. Izod /Charpy impact testing machine confirming to IS:1757.
5. Torsion testing machine hand operated or motorized.
6. Accessories: venier caliper,weighing balance, Weights, punch etc.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr S.R.Kukadapwar	HoD, Applied Mechanics	Government Polytechnic, Nagpur
2	Mr.Ateeque Azher	Lecturer	Government Polytechnic, Nagpur
3	Mr.H.L Wahane	Lecturer	Government Polytechnic, Nagpur
4	Mr.R.D.Dongarwar	Lecturer	Government Polytechnic, Nagpur

(Dr. D. K Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	AM202H
Course Title	:	Concrete Technology

I Rationale:

This course provides comprehensive knowledge of concrete technology for construction. Students learn to select and utilize concrete materials effectively, choose appropriate cement and aggregates, compile data for mix proportioning, and maintain concrete quality. This holistic approach ensures they can create durable, functional, and customized concrete mixes, contributing to successful construction projects while upholding quality, sustainability, and safety principles

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Suggest relevant grade of concrete for given work

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Suggest** relevant types of cement to be used in the given site conditions

CO2: **Use** relevant aggregates for required. Concrete works.

CO3: **Test** Compressive Strength of Concrete Cube

CO4: **Select** Data required for Mix proportion.

CO5: **Maintain** the quality of concrete

CO6: **Use** relevant admixtures for concreting for different site conditions

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Cement and Its properties	1a	Justify the given types of cement and their relevant use.	1.1	Chemical composition of cement OPC and PPC, Properties and their classificatins	CO1
	1b	Justify the need for the given chemical constituents for given type OPC	1.2	Hydration of cement, testing of physical properties of cement like fineness, normal consistency, initial setting time, final setting time, compressive strength and soundness. I.S. Specifications for ordinary Portland cement (OPC)	
	1c	Identify adulterations in the given cement at site	1.3	Grades of cement, Adulteration of cement, field tests, storing cement at site, effect of storage on properties of cement	
	1d	Suggest type of cement for a given condition with justification	1.4	Various types of cement and their uses, Rapid hardening cement, Low heat cement, Portland Pozzolana cement, Sulphate resisting cement, Blast furnace slag cement, white cement	

UNIT II: Aggregates and its properties	2a	Identify type of given aggregate samples based on source size and shape	2.1	Types of aggregates and its Classification	CO2
	2b	Suggest suitability of given fine aggregate	2.2	Properties of fine aggregates like size, specific gravity, bulk density, bulking and silt content	
	2c	Identify properties of given aggregate sample	2.3	Properties of coarse aggregate like size, shape, texture, strength, water absorption, crushing value, impact value, abrasion value, flakiness and elongation index	
	2d	Calculate fineness modulus of ggregate on given data	2.4	Determination of aggregate grading, sieve analysis and fineness moduluss	
	2e	Justify given Properties of aggregate with compressive strength of concrete	2.5	Effect of aggregate properties on strength of concrete	
UNIT III: Concrete and its properties	3a	Justify use of different grades of concrete and their prpoerties for given application with Justification	3.1	Introduction to concrete grades, definition and importance of concrete, process diagram for concrete, properties of concrete in green and hardened state	CO3
	3b	Select w/c for a given grade of concrete with justification	3.2	Duff Abram's water cement ratio (W/C) law, effect of W/C ratio on strength, durability and porosity of concrete, selection of Water Cement ratio, quality of water	
	3c	Illustrate factors affecting workability of given type concrete	3.3	Concept of workability and factors affecting workability, Slump test, Compaction factor test,workabilty for different works. Properties of harden concete: Shrinkage and Creep.	

	3d	Justify the given NDT Test	3.4	Compression Test on Concrete. Non-Destructive Testing (NDT) of Concrete, Importance and limitations only	
UNIT IV: Concrete Mix Proportion	4a	Justify use of given Different grades and Mix Prportios of concrete	4.1	Grades of concrete,Objectives of Concrete mix proportioning	CO4
	4b	Select data required for Mix Proportion	4.2	Necessity and factors affecting mix proportion	
	4c	Illustrate necessity and limitations of given mix proportion	4.3	Illustrate necessity and limitations of mix proportion	
UNIT V: Concreting Operations	5a	Identify suitable type of concrete mixer for given site condition	5.1	Batching of cement and aggregates by volume and by weight. Introduction to batching plant.Mixing concrete ingredients, types of Mixers-Tilting and Non-Tilting	CO5
	5b	Select method of transportation for given site condition	5.2	Transportation of concrete, methods of transportation, precautions to be taken during transportation	
	5c	Illustrate procedure of placing of concrete for given situation	5.3	Placing of concrete, precautions taken during placing concrete in formwork	
	5d	Select methods of compaction and finishing of concrete for given conditions	5.4	Compaction of concrete,methods of compaction, types of vibrator and precautions to be taken. Finishing of concrete, screeding, floating and troweling operations, use of power float	
	5e	Justify curing method for given situation with justification	5.5	Curing of concrete, purpose of curing, methods of curing-spraying water, membrane curing, steam curing, curing by wet gunny bags, ponding methods, chemical curing, duration of curing	
re in	6a	Illustrate the functions of given admixtures	6.1	Meaning of admixtures, functions of admixtures in concrete	

UNIT VI: Admixtu concrete	6b	Justify need of a particular admixture for given concrete mix	6.2	Various types of admixtures: Properties and use of Following types of admixtures.Air-entraining admixtures, Water-reducing admixtures, Plasticizers, Accelerating admixtures, Retarding admixtures and Coloring admixtures	CO6

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Determine fineness of OPC and PPC Cement	2	CO1
I	2	Determine quantity of water for cement paste of Normal consistency	2#	CO1
I	3	Determine initial and final setting time of cement	2	CO1
I	4	Determine compressive strength of cement	2#	CO1
I	5	Determine soundness of cement	2	CO1
II	6	Determine fineness modulus and water absorption of coarse aggrgate.	2#	CO2
II	7	Determine flakiness and elongation index of coarse aggrgate.	2	CO2
II	8	Determine abrasion value of coarse aggrgate	2	CO2
II	9	Determine impact value of coarse aggrgate.	2#	CO2
II	10	Determine crushing value of coarse aggrgate.	2	CO2
II	11	Determine fineness modulus of fine aggregade (Sand)	2#	CO2
II	12	Determine bulking of sand	2	CO2
II	13	Determine silt contents of Sand	2	CO2
II	14	Determine specific gravity of sand	2#	CO2
II	15	Determine bulk density of sand	2	CO2
III	16	Determine Slump of Fresh concrete	2#	CO3
III	17	Determine Compaction factor of concrete	2#	CO3
IV	18	Determine Compressive strength of concrete cube	2#	CO4

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a list of IS codes with their Specifications required for Cement, Aggregate and concrete (Any three codesfor each).
2. Select Seieves for Sieve Analysis for WMM (Wet Mix Macadam) and GSB(Granular sub base) courses
3. Prepare a report on stone crusher by observing its manufacturing of aggregates
4. Prepare a report on various methods of NDT such as Rebound Hammer method and Ultrasonic pulse velocity test
5. Prepare a report on hot & cold weather concrete.
6. Select type of cement for various types of construction works by doing Market survey.
7. Prepare a report on concreting operations by visiting a construction site.
8. Prepare a report on quality of fresh concrete by visiting a construction site
9. Prepare a report on farm work, scaffolding used and joints in concrete by visiting a construction site
10. Collect detail information about the ingredients of concrete mix by visite to site under construction.
11. Prepare a report on selection of admixture for relevant construction work.
12. Prepare a report on stone crusher by observing its manufacturing.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Cement and Its properties	10	C	06	04	04	14
			O	04	04	00	8
2	Aggregates and its properties	8	C	02	4	06	12
			O	00	00	06	6
3	Concrete and its properties	8	C	02	04	06	12
			O	02	04	00	6
4	Concrete Mix Proportion	6	C	00	04	06	10
			O	00	00	06	6
5	Concreting Operations	6	C	02	04	06	12
			O	00	08	00	8
6	Admixture in concrete	7	C	02	04	04	10
			O	02	00	04	6
Total		45	C	14	24	32	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	5R2	6R2	3R2	6R2	5	7
2	1R4	1U4	2U4	1R4	1U4			3	5
3	3U4	4U4	5U4	3U4	5U4			3	5
4	6U4	6A4	1A4	5U4	6A4			3	5
5	2A6	3A6	2A6					2	3
6	4A6	5A6	4A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing diagram, selection of equipment	5
2	Performance	5
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	10
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of topic	5
2	Report Content	10
3	presentation/Report writing	5
4	viva voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	3	-	3	3	-
CO2	3	-	-	3	3	-	3	3	-
CO3	3	-	-	3	3	-	-	-	1
CO4	3	-	1	3	3	-	3	3	-
CO5	3	-	-	3	3	-	3	3	-
CO6	3	-	-	-	-	-	3	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Concrete Technology	M.L. Gambhir, Tata McGraw Hill, FifthEdition,2013	13:9781259062551 10:1259062554
2	Concrete Technology	M.S. Shetty, S. Chand and Co, First Edition,2005	13:9788121900034 10:8121900034
3	Concrete Technology	S.Bhavikatti, I K International Publishing House Pvt. Ltd, First Edition,2015	13:9789384588670 10:9384588679
4	Concrete Technology	A.M. Neville & J.J. Brooks. Pearson Education, New Delhi	978-0-273-73219–8
5	Concrete Technology	A.R. Santhakumar, Oxford UniversityPress,FirstEdition,2006	13:978-0-195-67153-7

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XVI List of Major Equipment/Machineries with Specification:

1. Blaine's air permeability apparatus as per IS: 4031 (part 1)-1999
2. Vicats apparatus- VICAT mould of dia. 80 mm & 40 mm high glass base plate.
3. Compression testing machine-2000 KN capacity
4. NDT apparatus – Rebound Concrete Hammer
5. Cement mortar cube vibrator with moulds 6 Nos.
6. Slump cone (top dia.100mm, bottom dia.200mm, Height 300mm)
7. Density basket as per IS specification
8. Crushing Value Apparatus
9. Compaction Factor Test Apparatus
10. I S sieve set, sieve shaker with adaptors

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr S.R.Kukadapwar	HoD, Applied Mechanics	Government Polytechnic, Nagpur
2	MR.A.Ateeque Azher	Lecturer	Government Polytechnic, Nagpur
3	Mr.H.L Wahane	Lecturer	Government Polytechnic, Nagpur
4	Mr.R.D.Dongarwar	Lecturer	Government Polytechnic, Nagpur

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE201H
Course Title	:	Surveying

I Rationale:

The technology has brought the significant advancements in field of surveying. This will help civil engineers for accurate measurements of physical features of various construction projects and land with utmost accuracy, speed and easy operation of these surveying equipment's. The data obtained by various advanced surveying equipment's includes information of topography, grading, elevation, distances etc. Such data obtained helps civil engineers for future project planning and effective execution. The advanced surveying also helps in identifying potential risks associated with construction projects. This course will help students to acquire skills associated with surveying of land and buildings.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Conduct land survey and prepare topographical, contour maps, Longitudinal sections and cross sections of surveyed land.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** relevant type of survey required for the given situation.

CO2: **Locate** the traverse on field and mark the lines.

CO3: **Use** relevant equipments to determine area of Closed traverse.

CO4: **Prepare** plan using plane table survey.

CO5: **Carryout** levelling to plot Longitudinal Sections, Cross sections and Contour maps

CO6: **Set** out simple circular curves using linear and angular measurements.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Overview and Classification of Surveying	1a	Classify the survey based on given points and select survey method for given siitution.	1.1	Surveying: Introduction, Purpose, use and Principles.Types of surveying-Primary and Secondary classification, Plane, Geodetic, Cadastral, Hydrographic, Photogrammetry Aerial, Layout survey, Control survey, Topographical survey, Route survey, Reconnaissance survey.	CO1
	1b	Use the conventional sign and symbols for preparing plan of a given land.	1.2	Conventional sign and symbols used in maps.	
	1c	Identify given components of Electronic Distance Meter.	1.3	Electronic Distance Meter-Principle of measurement, Temporary adjustments, Merits and Demerits.	
ts	2a	Suggest application of the equipments for linear measurements.	2.1	Linear Measurement Instruments: Metric Chain,Tapes, Arrow, Ranging rod.	

UNIT II: Linear Measuremen	2b	Draw given lines of traverse based on given data.	2.2	Chain survey Station,Tie station, Base line, Check line, Tie line, Offset, Types of offsets: Perpendicular and Oblique.	CO2
	2c	Justify the measurement by given type of ranging.	2.3	Ranging: Direct and Indirect Ranging.Chaining on flat and sloping grounds.	
	2d	Determine the area of a closed traverse using given data of cross staff survey.	2.4	Cross staff survey for determining area of closed traverse using chain and cross staff.	
:II: Angular Measurements	3a	Calculate internal angles from bearings of the station.	3.1	Compass Traversing: open, closed.Technical Terms: Geographic/True Magnetic and Arbitrary Meridians and Bearings, Meridian and Bearing, Whole Circle Bearing System and Reduced Bearing System,Fore Bearing and Back Bearing, Calculation of internal and external angles from bearings at a station.	CO3
	3b	Identify given the Components of Prismatic compass.	3.2	Components of Prismatic Compass and their Functions Temporary adjustments and observing bearings.	
	3c	Use graphical adjustment method for ploting traverse.	3.3	Methods of plotting a traverse and closing error, Graphical adjustment of closing error.	
	3d	Identify given Components of transit Theodolite.	3.4	Component parts of transit Theodolite and their functions, Reading the Vernier of transit Theodolite,Fundamental axes of transit Theodolite and their relationship.	

UNIT I	3e	Compute Latitude, Departure. Independent coordinates from the data given.	3.5	Measurement of horizontal angle- Direct and Repetition method, Errors eliminated by method of repetition, Measurement of vertical Angle & Traverse computation- Latitude, Departure, Consecutive coordinates, independent coordinate & Traverse computation- Latitude, Departure, Consecutive coordinates, independent coordinate & Traverse computation- Latitude, Departure, Consecutive coordinates, independent coordinates, Balancing the traverse by Bowditch's rule.	
UNIT IV: Plain Table Surveying	4a	Identify the given accessory of plane table survey and its use.	4.1	Plane table survey- Principle, Use, merits and demerits & Accessories of plane table and their use, Telescopic alidade.	CO4
	4b	Justify the given method of Orientation of plane table.	4.2	Setting of plane table, Orientation of plane table - Back sighting and Magnetic meridian method.	
	4c	Select the relevant method of plane tabling for a given situation.	4.3	Methods of plane table surveys Radiation, Intersection and Traversing.	
ring	5a	Describe given terms used in levelling.	5.1	Terminologies: Level surfaces, level line, Horizontal and vertical surfaces, Datum, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Line of collimation, Back sight, Fore sight, intermediate sight, Change point, Height of instruments.	

UNIT V: Levelling and contour	5b	Select appropriate level and levelling staff for given task of levelling.	5.2	Types of levels: Dumpy, Auto level, Digital level, Fundamental axis of Level . Temporary adjustments of Level.Types of Levelling Staffs: Self-reading staff and Target staff.	CO5
	5c	Determine reduced levels of staff stations in levelling work using given method.	5.3	Types of Leveling : Simple, Differential, Fly, Profile and Reciprocal Levelling Height of instrument method and Rise and Fall Method of calculation of reduced levels.	
	5d	Interpret the given contour map.	5.4	Contour, contour interval, horizontal equivalent. Contour maps: Characteristics and uses of Contour maps.	
	5e	Plot contour by given method.	5.5	Methods of Locating Contour: Direct and Indirect.	
UNIT VI: Curves setting	6a	Suggest the types of curve to be used in alignment of road /railwayfor given alignment.	6.1	Curve: Definition, Types of curves used in roads and railway alignments. Necessity of Curves.	CO6
	6b	Identify the components of a given simple circular curve.	6.2	Notations of simple circular curve, Designation of the curve by Radius and Degree of curve.	
	6c	Determine the required data for setting out the curve by given method.	6.3	Setting simple circular curve by offsets from long chord and Rankine's method of deflection angles.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Measure the distance between two intervisible survey stations using chain, tape and ranging rods and Check with EDM.	2#	CO1
II	2	Perform Chain and Cross staff Survey to determine the area of a given field.	2#	CO2
III	3	Observe the Fore Bearing and Back bearing of a closed traverse of 5 to 6 sides and correct the observed bearings and included angles.	2#	CO3
III	4	Measure Horizontal angle by using Transit Theodolite by Direct Method and Repeatition Method.	2#	CO3
III	5	Measure Vertical angle by using Transit Theodolite.	2#	CO3
III	6	Use transit theodolite to carry out Survey of closed traverse for minimum 5 sides (part I).	2#	CO3
III	7	Use transit theodolite to carry out Survey of closed traverse for minimum 5 sides (Part II).	2#	CO3
IV	8	Perform Plane table survey of given area by Radiation Method.	2#	CO4
IV	9	Perform Plane table survey of given area by Intersection Method.	2#	CO4
IV	10	Perform Plane table survey of given area by Traversing Method.	2#	CO4
V	11	Carry out differential levelling and calculate the Reduced levels of the points using H. I. Method and Rise and Fall Method	2#	CO5
V	12	Perform Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval (part I).	2#	CO5
V	13	Perform Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval (part II).	2#	CO5
VI	14	Set out of a circular curve by offsets from Long Chord Method.	2#	CO6
VI	15	Set out of a circular curve by Rankine's Method of Deflection angles Method.	2#	CO6

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Overview and Classification of Surveying	4	C	00	04	00	4
			O	02	00	00	2
2	Linear Measurements	12	C	04	06	06	16
			O	02	06	00	8
3	Angular Measurements	12	C	04	06	08	18
			O	00	06	04	10
4	Plain Table Surveying	3	C	02	04	00	6
			O	00	04	00	4
5	Levelling and contouring	12	C	04	06	10	20
			O	04	06	00	10
6	Curves setting	2	C	02	04	00	6
			O	00	00	06	6
Total		45	C	16	30	24	70
			O	8	22	10	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	2R2	3R2	4R2	5R2	5R2	1R2	2R2	5	7
2	2U4	1U4	2A4	5A4	3A4			3	5
3	5R4	2R4	3U4	5U4	4U4			3	5
4	5U4	6U4	6U4	6U4	6A4			3	5
5	4U6	2A6	3A6					2	3
6	3A6	5A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing diagram of object, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Drawing diagram of object, selection of equipment	5
2	Writting report	10
3	Results	5
4	Viva voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	3	3	-	-
CO2	3	-	-	3	-	3	3	-	-
CO3	3	-	-	3	-	3	3	-	-
CO4	3	-	-	3	-	3	3	-	-
CO5	3	-	-	3	-	3	3	-	-
CO6	3	-	-	3	-	3	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Surveying and Levelling volume I	Kanetkar T. P.; Kulkarni, S. V. Pune Vidyarthi Gruh Prakashan, Pune;	13: 978-81-858-2511-3
2	Surveying and Levelling	Basak, N. N.McGraw Hill Education, New Delhi	10: 93-3290-153-8
3	Surveying	Saikia, M D.; Das. B.M.; Das. M.M,PHI Learning, New Delhi	13: 978-81-203-3985-9
4	Fundamentals of Surveying and Levelling	R. Subramanian Oxford University Press. New Delhi.	10: 0-19-945472-8
5	Survey I	S. K. Duggal, McGraw Hill Education, New Delhi.	13: 978-00-701-5137-6
6	Surveying I	Punmia, B.C, Jain, Ashok Kumar Jain, Arun Kuma,Laxmi Publications., New Delhi.	10: 8-17-008853-4

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6. https://civilplanets.com/compass-surveying/ / assessed on 20 may 2024
7. http://ecoursesonline.iasri.res.in/mod/page/view.php? id=128285 / assessed on 20 may 2024
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9. https://youtu.be/j8poe2vvD2Q / assessed on 20 may 2024
10. https://www.youtube.com/watch?v=c9U0xlmCzGI / assessed on 20 may 2024

XVI List of Major Equipment/Machineries with Specification:

1. Dumpy level and Automatic set level
2. Thedolite with accessories
3. Electronic Distansometer with accessories
4. Plane table with accessories- Plane and telescopic Alidade, Trough compass, U-fork, Spirit level.
5. Total station with accessories and Batteries

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. W. Pawde	HOD,Civil Engineering	Government Polytechnic, Nagpur
2	Dr D.N. Kongre	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mr. N.U.Sulbhewar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er.G. B. Takey	EE. Vigilance & Quality Control	Public Works Department,Nagpur
5	Dr.Abhay Shende	Principal	JL Priyadarshni College,Nagpur
6	Dr.V.G. Kondekar	Head, civil Engineering	Government Polytechnic,Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE202H
Course Title	:	Highway Engineering

I Rationale:

Efficient network of road is the life line of any nation. Highway engineering is one of the most favored-effectiveand economical modes of land transportation. It is instrumental in determining the economic development of thecountry. Highway and Transport facilities are an important part of urban infrastructure. Highway engineering is oneof the branches of Civil engineering which deals with the process of design, construction, and maintenance ofdifferent types of roads. The basic requirements of efficient transportation are speed, safety, and comfort. It providesdoor to door service and connects to inaccessible parts of the country. Hence it is essential for Civil engineeringstudent to acquire the knowledge of this course.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Contruct and maintain highways and pavements.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Classify** the roads.

CO2: **Implement** geometrical features of Highways.

CO3: **Observe** the various road construction activities.

CO4: **Suggest** the relevant precautionary measures to control the drainage based on inspection to maintain the given section of roads

CO5: **Identify** the components of bridge.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Highway Engineering	1a	Describe the given modes of transportation.	1.1	Different modes of transportation and its importance.	CO1
	1b	Describe the Role of IRC, NHAI in the development of roads in India.	1.2	History of the Road development in India and theagencies involved in this work.	
	1c	Classify the given type of Roads.	1.3	General classification of Roads.	
	1d	Justify the given factor influencing the ideal alignment of road pavement.	1.4	Alignment: Definition, Requirements, importance etc. of an ideal road alignment and the factors affecting road alignment.	

UNIT II: Geometric Elements of Highway	2a	Illustrate given functional terms related to geometrics of highway with sketches.	2.1	Definition, purpose, types, and its IRC recommendationof Various geometric elements /Technical terms of roadpavement :Permanent way/right of way, road formation,Carriageway width Road margin, side slopes, side gutter,Camber, Gradient, Super elevation, Curves, RoadWidening, Sight distance, Design speed and factors affecting design speed.	CO2
	2b	Sketch / Draw the cross sections of roads in embankment and cutting for the given site condition.	2.2	Standards cross-sections of EXPRESSWAY, NH, SH,MDR, ODR and VR in embankment and cutting.	
UNIT III: Construction of Road Pavements	3a	Describe the specific test on given sample of bitumen.	3.1	Overview of highway construction materials:Aggregate, Cement, Sand, Water, Soil, Bitumen: Ductility,Flash and Fire Point Test, Softening Point Test, ExtractionTest, Grade of Bitumen, Emulsion, Cutback, Tar.	CO3
	3b	Differentiate between the flexible and rigid pavement with respect to given parameters.	3.2	Definition, Types, Structural Components of pavementand their functions.	
	3c	Describe the importance of given type of layer in given type of road.	3.3	Construction of WBM road, Flexible pavement /Bituminous Road. Describe it in detail.	
	3d	Justify the importance of the given pavement including joints and sealers.	3.4	Construction of Rigid Pavement (Cement Concrete) :methods of construction, Alternate and Continuous Bay Method, Construction joints, filler and sealers.	
	3e	Suggest relevant measures to control the land slide in the given situation.	3.5	Components, functions of Hill roads.Land slides: define, Causes, Types Prevention of land slides.	

UNIT IV: Road Drainage and maintenance	4a	Describe with sketches the relevant method of providing drainage in the given type of Road.	4.1	Drainage-Definition, necessity, types and sketch of drainage system.	CO4
	4b	Identify the causes of failure based on inspection of given type of pavement.	4.2	Failure of flexible and Rigid pavement and Its Causes and preventive measures.	
	4c	Suggest the maintenance and repair works required for given type of defective road.	4.3	Necessity of Maintenance of Road & its Classification.	
UNIT V: Bridge Engineering	5a	Classify the bridges according to given criteria.	5.1	Classification of bridges according to function, material, span, size, Alignment, position of HFL.	CO5
	5b	Identify a suitable site for bridge considering the factors affecting its selection.	5.2	Factor affecting the selection of Bridge Site.	
	5c	Describe terms related to bridge.	5.3	Basic terms: Scour, Afflux, Runoff, Economic Span, Clearance, and Freeboard.	
	5d	Select the component parts of bridge from given options to satisfy the given criteria with justification.	5.4	Component of Bridge and its function, L-section, Cross section. Piers-function, requirements, types. Abutment – function and types. Wing walls – functions and types. Bearing – functions, types of bearing for RCC and steel bridges. Approaches –in cutting and embankment.	
	5e	Identify various types of bridges.	5.5	Types of bridges.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Draw the sketches showing standard cross sections ofNH, SH, MDR, ODR, VR in embankment and cuttingon A3 size sketch book.	2#	CO1
II	2	Visit the existing road to identify the component partsof road and prepare photographic report.	2#	CO2
III	3	Conduct Softening point test on bitumen.	2#	CO3
III	4	Conduct Penetration test on bitumen.	2#	CO3
III	5	Conduct Flash and Fire Point test on bitumen.	2#	CO3
III	6	Conduct Ductility test on Bitumen.	2#	CO3
III	7	Conduct Bitumen Extraction Test.	2#	CO3
III	8	Visit the road under construction to identify layers inthe flexible pavement/Rigid Pavement. Prepare photographic report consisting of Materials, Machineries used, Method of Construction and on-site testing of Materials.	2#	CO3
III	9	Visit the hill road to study its components, geometrics and prepare the photographic report containing details.	2	CO3
IV	10	Visit the road of any one type flexible or rigid to knowthe road drainage system.	2#	CO4
IV	11	Visit the road to identify the defects in road and suggest the possible remedial measures for it and prepare photographic report.	2	CO4
IV	12	Suggest possible repairs and maintenance of the road visited in your city/ town/ village.	2#	CO4
V	13	Draw Plan, L section and Cross section bridge.	2	CO5
V	14	Prepare a report on visit to a road way bridge to observe the componants.	2#	CO5
V	15	Prepare a report on various types of bridges.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Highway Engineering	2	C	04	00	00	4
			O	02	00	00	2
2	Geometric Elements of Highway	8	C	00	08	10	18
			O	02	04	06	12
3	Construction of Road Pavements	6	C	06	06	04	16
			O	04	04	00	8
4	Road Drainage and maintenance	6	C	00	08	04	12
			O	00	04	04	8
5	Bridge Engineering	8	C	04	06	10	20
			O	00	04	06	10
6		0	C	0	0	00	0
			O	00	00	00	0
Total		30	C	14	28	28	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	3R2	5R2	5R2	1R2	2R2	5	7
2	2U4	2U4	2A4	2U4	3R4			3	5
3	3R4	3A4	4U4	3U4	4U4			3	5
4	4U4	4A4	5A4	4A4	5U4			3	5
5	2A6	3U6	2A6					2	3
6	5U6	5A6	5A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing Cross sections of road	5
2	Performance	10
3	Drawings / sketches	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	2	2	-	-	-	-
CO3	3	-	-	2	2	3	-	-	-
CO4	3	-	-	2	2	3	-	-	-
CO5	3	-	-	2	-	3	-	-	-
CO6									-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Highway Engineering	Khanna S.K., Justo, C E Gand Veeraragavan, A.	978-8185240800
2	Principles and Practices of Bridge Engineering.	S. P. Bindra. Dhanpat Rai Publications (6 December 2012).	978-8189928841
3	Laboratory Manual in Highway Engineering	Duggal, Ajay K. and Puri, V.P.	9788122403107
4	Transportation Engineering theory and practice	Raji A. K. and K. K. Babu	978-81-960576-1-9
5	Transportation Engineering	N L Arora	New India Publishing House, New Delhi ...

XV e-References:

1. https://www.youtube.com/watch?v=5zKC_aq4ypM&list=PLE88643285 accessed on 20/05/2024
2. https://crridom.gov.in/ accessed on 20/05/2024
3. https://www.irc.nic.in /accessed on 20/05/2024
4. https://nhai.gov.in/#/ accessed on 20/05/2024
5. https://msrdc.in/1307/Home accessed on 20/05/2024
6. https://nitsri.ac.in/Department/Civil%20Engineering/Bridge-Introduction-8th-civil.pdf. accessed on 20/05/2024

XVI List of Major Equipment/Machineries with Specification:

1. Ring and Ball test apparatus (Hot plate 160mm dia. with magnetic stirrer, brass ring, steelball and glass vessel 600ml and glass thermometer +800c.

2. Digital Analytical Weighing Scale, Accuracy: 1 Mg capacity : 30 g to 300 g
3. 1) Lab Safety products (Heat Resistant Gloves, PPE Kit for Laboratory work, etc.) 2)Laboratory items-Lab Utensils and Hand Tools and Sample Containers and Bags
4. Standard Penetrometer with penetration needle 100gm weight, container 55mm dia. and53mm ht. as per IS:1203.
5. Pensky Marten's Flash and Fire Point test apparatus 100x200x240mm with measurementrange 0-95 as per IS:1209-1953
6. Ductility Testing Machine with ductility mould and base plate.
7. Bitumen Extraction Test Apparatus: - Centrifuge Extractor, Electrical Operation, Capacity1500g, with a Dimmer stat for speed control from 2,400 to 3,600 rpm. Suitable for operationon 230 V, 50 Hz, Single Phase, A.C. supply.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	HOD, Civil Engineering	Government Polytechnic, Nagpur
2	Dr S. J. Nikam	Lecturer Civil Engineering	Government Polytechnic, Nagpur
3	Mr. R. M. Walke	Lecturer Civil Engineering	Government Polytechnic, Nagpur
4	Dr. B. R. Ambade	Lecturer Civil Engineering	Government Polytechnic, Nagpur
5	Er. G.B. Takey	EE, Vigilence and Quality Control	PWD Nagpur
6	Dr Abhay Shende	Principal	J. L. Priyadarshani College Of Engineering
7	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	SEC
Course Code	:	CE251H
Course Title	:	Building Drawing with CAD

I Rationale:

Building planning and drawing are critical components of the construction process, enabling stakeholders to visualize, communicate, problem-solve, comply with regulations, estimate costs, guide construction, and ensure quality throughout the project lifecycle. In today's era of globalization and technology revolutions, it is necessary to prepare the civil engineering drawings in such a way that it can be prepared with utmost precision and accuracy with ability to modify it as and when required. This is only possible if the said drawing is prepared using the CAD software. This course is therefore planned with the goal of developing such competency among the learners.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use CAD software for design & documentation

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Draw** the line plans of residential & public buildings considering the Principles of Planning.

CO2: **Use** CAD software for drafting and editing of Civil Engineering drawing.

CO3: **Draw** Submission & working drawing of load bearing & framed Structure.

CO4: **Draw** & analyze the elements of landscape design.

CO5: **Draw** the Isometric and 3- Dimensional drawings of Civil Engineering structure using CAD.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	4	-	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	50	20	50+	10	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
e of planning	1a	Use natinal building code.	1.1	Introduction rules and bye laws such as SP7, National Building code of India (NBC),Unified development control and promotion.regulation for Maharashtra State (UDCPR), Building Plan Management System BPMS),of sanctioning authorities for construction works. (MPCB), Maharashtra Pollution Control Board.	
	1b	Use Sun diagram & IS 962-1989 for norms & space requirement.	1.2	Selection of site for building construction. Space requirement and norms for minimum dimension of different units in the residential and public buildings as per IS 962-1989. Use and Significance of Sun diagram.	

UNIT I: Building bye laws & principl	1c	Draw line plans for the given residential and public building using principle of planning.	1.3	Principles of planning of Residential and Public building Aspect, Prospect, Orientation,Grouping, Privacy, Elegance, Flexibility,Roominess, Circulation,Sanitation, cleanliness, Economy.	CO1
	1d	Compute built up, carpet and plinth, super built up area for the given building.	1.4	Plot area, built up area, super built up area, plinth area, carpet area, floor area and FSI (Floor Space Index) Concept of TDR (Transferable Development Rights), its eligibility and non eligibility. Line plans for residential building of minimum three rooms including W.C., bath and staircase as per principles of planning. Line plans for public building school building, primary health centre, bank, post office, and hostel, function hall, mall and library.	
	1e	Collect Information of an ancient Indian culture related to Civil Engineering structure drawing.	1.5	Correlate ancient Indian sculptures, Indian temples, Monuments etc. with Civil Engineering structure drawing.	
Drawing	2a	Incorporate the various software available.	2.1	Fundamentals- various drafting software for civil engineering applications. System requirement for drawing software. Advantages of computer aided drawing over traditional method of drawing.	
	2b	Use initial setttings & commands in CAD.	2.2	Initial setting required to start new drawing Draw commands- line, poly line, construction line, rectangle, polygon, circle, ellipse, hatch, boundary, text,arc, point, make block.	

UNIT II: Computer Aided	2c	Calculate the parameters like distance, area, perimeter of a given figure.	2.3	Modify commands- erase, copy, mirror, offset, trim, move, extend, rotate, array,lengthen, scale, chamfer,fillet, explode, stretch Compute area of the given drawing Changing properties of entity line type, color, scale, font size, color, style.	CO2
	2d	Use the concept of layer & diamention toolbar to visualize the specific component of the building/drawing.	2.4	Layer command- Create layers for given components of given drawing Dimension toolbar- quick dimension, linear dimension, and continuous dimension; align dimension, angular dimensions, dimension style.	
	2e	Use the plot / Print command for the given drawing.	2.5	Plot / print command for the output of given drawing.	
T III: Drawing of load bearing & framed Structure	3a	Draw developed plan, elevation, section, site plan from the given line plan for load bearing structure.	3.1	Drawing of Single storey Load Bearing & framed residential building (2 BHK) with staircase.	
	3b	Prepare working drawing of the given drawing.	3.2	Concept of working drawing and submission drawing	
	3c	Prepare foundation plan of the given load bearing residential building.	3.3	Data drawing – developed plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement. Planning and design of staircase - Rise and Tread for residential and public building. Working drawing – developed plan, elevation, section passing through staircase or W. C. and bath Foundation plan of load bearing & framed structure.	CO3

UNI	3d	Draw component parts of the given Framed structure.	3.4	Component drawing of RCC slab,chajja,column footing, beam etc for given structure.	
UNIT IV: Landscape Architecture	4a	Interpret the terms related landscaping.	4.1	Nature and man, Urban landscape, soft and hard landscape. Role of landscape designer.	CO4
	4b	Incorporate the principle of landscaping.	4.2	Basic landscaping principles Draw landscape drawing of proposed project.	
	4c	Introduces basic principles, tools, and commands relevant to landscape design.	4.3	Designing Landscape elements such as paths, patios, walls, and structures ,and creating detailed drawings and construction documentation landscape features.	
UNIT V: Introduction to 3-D diamensionl Drawing	5a	Justify the need of isometric drawing in civil engineering.	5.1	Isometric drawing- meaning and necessity, use of isometric snap, isometric axes, isocircle, isotext.	CO5
	5b	Prepare 3-dimensional drawing using the relevant 3 Dimensional Modify Commands.	5.2	Dimensional drawing –use of,Extrude,Presspull, Union,Subtraction command for preparing drawing of components-Beam, Columns etc	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Collect essential documents from any architect, planning consultant, planning Engineer, sanctioning authority department & write report on sketch book.	2	CO1
I	2	Interpret the architectural drawing & write a summary of observations of all technical details from the given drawing (1BHK / 2BHK) obtained from the professional architecture civil engineer correlate with byelaws and regulations on sketch book.	2#	CO1
I	3	Draw various types of graphical symbols for materials, doors and windows as per IS 962:1989 on Sketch book.	2#	CO1
I	4	Draw various types of graphical symbols for sanitary,water supply as per IS 62:1989 on Sketch book.	2#	CO1
I	5	Draw various types of graphical symbols for electrical installations and write abbreviations as per IS962:1989 on Sketch book.	2	CO1
I	6	Measure the units of existing building (Load Bearing /Frame structure) & Draw line plan of measured existing building using scale on sketch book.	2#	CO1
I	7	Measure the units of existing building (Load Bearing /Frame structure) & Draw line plan of measured existing building using scale on sketch book using scale on sketch book -(Part -II).	2	CO1
I	8	Draw line plan to suitable scale (Minimum 1BHK, staircase, WC and Bathroom) for Residential Bungalows using scale on sketch book. (Minimum three).	2	CO1
I	9	Prepare Line plan of Residential Building with staircase (minimum two) using CAD Software.	2#	CO1
I	10	Draw line plans on sketch book to suitable scale for Public Buildings- Bank, Post Office on Sketch book	2#	CO1
I	11	Draw line plans to suitable scale for Public Buildings –Hostel, Library on Sketch book.	2#	CO1

I	12	Draw line plans to suitable scale for Public Buildings - Primary Health Centre on Sketch book.	2#	CO1
I	13	Draw line plans to suitable scale for Public Buildings - Bus Stand/Small railway station on Sketch book.	2#	CO1
I	14	Draw line plans on sketch book to suitable scale for Public Buildings- Restaurant, Mall Office on Sketch book.	2	CO1
II	15	Explore the components of CAD screen & apply the process of initial setting using format menu.	2#	CO2
II	16	Explore the various command of CAD to draw a structure.	2#	CO2
III	17	Draw submission drawing to suitable scale of a single storey load bearing residential building (2BHK) with flat Roof and staircase showing Developed plan and elevation by using CAD software (print on A2 size sheet) - (Part I).	2#	CO3
III	18	Contd. Pr. 17: Draw section for section line passing through Stair or W.C. and Bath for Plan using CAD Software (print on A2 size sheet) - (Part II)	2#	CO3
III	19	Contd. Pr. 17: Draw Foundation plan and write schedule of openings. Draw Site plan with suitable scale, write area statement, and construction notes for Plan in Practical No.17 by using CAD Software (print on A2 size sheet) -(Part III).	2#	CO3
III	20	Draw submission drawing, to the suitable scale of (G+1) Framed Structure Residential Buildin(2BHK) with Flat Roof and staircase showing: Developed plan b) Elevation by using CAD Software (print on A2 size sheet) – (Part I).	2#	CO3
III	21	Contd. Pr. 20: Draw Section for section line passing through Stair, W.C. and Bath For plan in Practical No.20 by using CAD Software (print on A2 size sheet) - (Part II)	2#	CO3
III	22	Contd. Pr. 20: Draw Site plan and write area statement, Schedule of openings and construction notes by using CAD Software (print on A2 size sheet) - (Part III).	2#	CO3
III	23	Contd. Pr. 20: Draw Foundation with suitable scale by using CAD Software. (print on A2 size sheet).	2#	CO3

III	24	Draw Detailed enlarge section of RCC column and footing with suitable scale by using CAD Software.(print on A2 size sheet).	2#	CO3
III	25	Draw Detailed enlarge section of RCC Beam, Lintel and Chajja with suitable scale by using CAD Software (print on A2 size sheet).	2#	CO3
III	26	Draw Detailed enlarge section of RCC staircase with suitable scaleby using CAD Software (print on A2 size sheet).	2#	CO3
III	27	Draw Detailed enlarge section of RCC Slab with suitable scale by using CAD Software. (print on A2 size sheet).	2#	CO3
IV	28	Draw landscape architecture drawing of given residential building project on half imperial size sheet. (Free hand drawing).	2#	CO4
V	29	Draw 3-D view of simple object. (any one) - using CAD Software.	2#	CO5
V	30	Draw 3-D view of simple 1BHK using CAD Software.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Building bye laws & principle of planning	7	C	0	0	0	0
			O	0	0	0	0
2	Computer Aided Drawing	4	C	0	0	0	0
			O	0	0	0	0
3	Drawing of load bearing & framed Structure	12	C	0	0	0	0
			O	0	0	0	0
4	Landscape Architecture	3	C	0	0	0	0
			O	0	0	0	0
5	Introduction to 3-D diamensionl Drawing	4	C	0	0	0	0
			O	0	0	0	0
Total		30	C	0	0	0	0
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

-----NA-----

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Preparation of drawing using drawing lines & uniformity of line work	20
2	Creating of drawing ,Dimensioning techniques ,lettering	10
3	Title block & evaluation of drawing	10
4	vivavoce	10
	TOTAL	50

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	2	1	-	2	-	-
CO3	3	-	-	2	-	-	2	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	2	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Building Drawing	M. G. Shah, C.M. Kale, Mc Graw Hill Publication	13: 978-0071077873
2	Planning and Designing of Building	Y. S. Sane, Allies Book Stall	10: 8180140725
3	Architectural Design	Ernest Pickering, J. Wiley & Sons	10: 1258824094
4	A to Z of Practical Building Construction and its Management	Sandeep Mantri, New Delhi	Satya Prakashan, 13: 9788176842051
5	IS 962 (1989): Code of practice for architectural and building drawings [CED 51: Planning, Housing and pre-fabricated construction]	Bureau of Indian Standard, New Delhi	-
6	Civil Engineering Drawing (including Architectural aspects)	M. Chakraborti, Tech-Knowedge Publication	-
7	Modern Home Plan and Vastu	M.Chakraborti, Monojit Publication, 2022	-

XV e-References:

1. https://dtp.maharashtra.gov.in/en/dcr Assessed on 19/05/2024.
2. https://www.youtube.com/watch?v=FF_5w5hZav4 Assessed on 19/05/2024.
3. https://www.youtube.com/watch?v=_Whnb7EyOfA Assessed on 19/05/2024.
4. https://www.youtube.com/watch?v=OwWM6kmTreI Assessed on 19/05/2024.
5. https://www.youtube.com/watch?v=mvdrhIzZF8c Assessed on 19/05/2024.
6. https://youtu.be/pRIz2iv5yLc Assessed on 19/05/2024.

XVI List of Major Equipment/Machineries with Specification:

1. Computer with specification as 8GB RAM,Graphics Card 4 GB, HDD/SSD 500GB, LCD Monitor with relevant CAD software. (with latest configuration)
2. Printer A3 size, Print, Scan, Copy, ADF, Auto Duplex,WiFi,Network Printer, Black, Medium
3. LCD Projector

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	HOD, Civil Engineering	Government Polytechnic Nagpur
2	Mr.N.U.Sulbhewar	Lecturer in civil Engineering	Government Polytechnic Nagpur
3	Mrs.N.K.Deshmukh	Lecturer in civil Engineering	Government Polytechnic Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur
6	Dr. V. G. Kondekar	Head, Civil Engineering	Govt. Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/AE/CM/TX/PK/MT/TR/AI/MK
Course Category	:	VEC
Course Code	:	VE252H
Course Title	:	Yog and Meditation

I Rationale:

The biggest challenge to student success is stress management, health management, sleep difficulties and depression. World Health Organization (WHO) emphasizes yog and meditation to prevent physical and mental stress. The prime objective of this course is a holistic development of mind and body by incorporating four primary components: physical exercises, breathing exercises, deep relaxation techniques and meditation. The daily practice of the course will prepare student to gain more physical, mental and emotional strength. This course supports the requirements of the National Education Policy (NEP).

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Practice Yog and Meditation in daily life.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Improve** Physical strength, balance and flexibility.

CO2: **Enhance** concentration and retain memory.

CO3: **Increase** energy flow within body and develop positive attitude.

CO4: **Support** stress management, mental health and ensure quality sleep.

CO5: **Develop** healthy eating habits and physical & mental hygiene.

CO6: **Maintain** a balanced metabolism and boost immunity.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
--	-	2	2	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	25	10

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Introduction to Yog (Anatomy of Body) and know importance of Yog. Measure weight & height. Calculate BMI (Body Mass Index).	1#	CO1
I	2	Practice Sharirsanchalan, Padasanchalan. Practice basic asana: Uttitvivekasana (Standing Poses :Minor Exercises of Hands and Leg).	1#	CO1
I	3	Repeat day two. Practice Sharirsanchalan of Back (Reclining poses: Minor excercise of Back). Practice Pavanamuktasana.	1#	CO1
I	4	Repeat day two & three. Practice Ashtanga Yog (Yama, Niyam, Asan, Pranayam, Pratyahar). Prepare a Diet Plan for self. Ashtanga Yog in details.	1#	CO1
I	5	Repeat day two, three & four. Practice Sharirsanchalan of Stomach and Bhuja.	1#	CO1
I	6	Repeat day two. Practice Standing Poses Asana: Tadasana,Vrukshasana, Trikonasan, Hastapadasan.	1#	CO1
I	7	Repeat day three. Practice Reclining Poses Asana:Pavanamuktasana,Noukasana. Sandhisanchalana of neck,heap,	1#	CO1
I	8	Repeat day seven. Practice Sandhisanchalana of neck & heap.	1#	CO1

I	9	Repeat day eight. Practice Reclining Poses Asanas: Setubandhasana,Chakrasana,Halasana.	1#	CO1
I	10	Repeat day five. Practice Seated Poses Asanas : Padmasana, Aakarnadhanurasana, Ardhtitali, Purnatitali.	1	CO1
I	11	Repeat day two. Practice 12 poses of Surya Namaskara slowly with pace.	1#	CO1
I	12	Repeat day two. Practice 12 poses of Surya Namaskara in continuation (maximum repeatation as per capacity)	1	CO1
I	13	Practice Sandhisanhalan of feet, neck, hands, joints eyes etc. Practice Seated Poses asanas :Padmasana, Pacchimottanasana, Vakrasana, Gomukhasana	1	CO1
II	14	Introduction of Pranayama and know its benefits. Practice Dirghashwasan, Anulom Vilom and Agnisara.	1	CO2
II	15	Repeat day fourteen. Practice Kapalbharti and Nadi Shodhan Pranayama.	1	CO2
II	16	Practice Sharirsanchalan. Repeat day fifteen. Practice 5 types of Nadi Shodana Pranayama.	1	CO2
II	17	Repeat Sharirsanchalana and day sixteen. Practice Shitali Pranayama, Sitakari Pranayama, Sadanta Pranayama.	1#	CO2
III	18	Repeat Sharirsanchalana. Practice basic Pranayamas. Introduction to Bandhas and know about Mulbandha, Jalandhar Bandha.	1	CO3
III	19	Repeat Sharirshanchalan and day eighteen. Practice Udiyana bandha and Maha bandha.	1	CO3
III	20	Repeat day sixteen. Practice Bhastrika Pranayam:type 1 and 2.	1	CO3
III	21	Repeat Sharirsanchalan and day 20. Practice Bhastrika Pranayam:type 3, 4 and 5.	1	CO3
IV	22	Repeat Sharirsanchalan and day 21. Practice Ujjaiyi Pranayam.	1#	CO4
IV	23	Repeat Sharirsanchalan and day 19, 20, 21 and 22. Practice Vyaghrasana.	1	CO4
IV	24	Repeat Sharirsanchalana and Suryanamaskara. Introduction to meditation and know about benefits of meditation. Practice concentration on Breathing (Inhalation & exhalation).	1#	CO4
V	25	Repeat day 24. Pratice Savasana (Relaxation Technique)	1#	CO5
V	26	Practice Sharirsahchalana. Know bout balancing techniques of body. Practice Mayurasana.	1	CO5
V	27	Repeat Sharirsanchalan and 12 poses of Suryanamaskara.	1	CO5

V	28	Introduction to Body Purification Method: Neti and know the steps & benefits of Neti.	1	CO5
VI	29	Practice Purification Method :Perform Neti,Jala Neti (Note: Should be done in the presence of guide)	1	CO6
VI	30	Measure weight. Recalculate BMI	1#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a report on daily practice of yog and meditation by you. Attach Google tag photographs in the report.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Body alignment for each flow	5
2	Breathing	5
3	Performance Flow and Sequencing	5
4	Attendance	10
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Content	10
2	Report Writing	10
3	Viva-voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	2	-	2	-	-
CO5	3	-	-	3	2	-	2	-	-
CO6	3	-	-	3	2	-	2	1	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Sulabh Sanghik (Part 1)	Janardhan Swamy Yogabhyasi Mandal, Ramnagar, Nagpur	-
2	Sulabh Sanghik (Part 2)	Janardhan Swamy Yogabhyasi Mandal, Ramnagar, Nagpur	-
3	Surya Namaskar (JSYOG)	Janardhan Swamy Yogabhyasi Mandal, Ramnagar, Nagpur	-
4	Pranayam Book (JSYOG)	Janardhan Swamy Yogabhyasi Mandal, Ramnagar, Nagpur	-

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1. https://yoga.ayush.gov.in/public/assets/front/pdf/CYP-2023-English.pdf assessed on 27th May 2024
2. https://jsyog.org/yogasana/ assessed on 27th May 2024
3. https://jsyog.org/pakshik-yog-varg/ assessed on 27th May 2024
4. https://yoga.ayush.gov.in/Publications/index.php?bt=2 assessed on 27th May 2024
5. https://yoga.ayush.gov.in/public/assets/IDY_ebook.pdf assessed on 27th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Yoga and Meditation Kits
2. Weighing machine
3. Measuring tape
4. Yoga mats

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M.B.Daigavane	Principal	Government Polytechnic, Nagpur
2	Mrs. Santoshee Soni	Yoga Trainer	Janardan Swami Yogabhyasi Mandal, Nagpur
3	Ms. Nandini Menjoge	Yoga Trainer	Janardan Swami Yogabhyasi Mandal, Nagpur
4	Dr G.V. Gotmare	Member Secretory Borad of Studies	Government Polytechnic, Nagpur
5	Dr. Megha Bhelande (Machale)	Lecturer in English	Government Polytechnic, Nagpur.

(Dr. G. V. Gotmare)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
Member Sectretary PBOS,

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AE/MT/PK/TX/MK/AI
Course Category	:	INP
Course Code	:	IN251H
Course Title	:	Internship (Basic)

I Rationale:

The Basic Internship course provides diploma students in engineering with a four-week summer vacation internship opportunity after the second semester. The internship encompasses various inter/intra-institutional activities aimed at skill development, innovation, and professional growth. Students engage in practical experiences within institutional settings and are evaluated based on their daily activities documented in a diary.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply theory, engage in diverse learning, develop soft skills, document, and present internship experiences.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** theoretical knowledge in practical engineering challenges.

CO2: **Participate** in trainings, conferences, workshops, competitions, and institutional laboratories work to enhance learning.

CO3: **Develop** essential soft skills through training, workshops, conferences, competitions, and institutional laboratories work.

CO4: **Prepare** daily diaries and internship report for evaluation by faculty mentors.

CO5: **Present** internship report for evaluation by faculty mentors

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	6	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	-	-	-	-	50	20

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)	Topics and Sub-topics	Aligned Cos

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Introduction to Real-World Engineering Challenges - Identify internship project area, Identify common engineering problems in related fields of engineering (Electrical, Civil, Computer etc.), Discuss with mentor on the importance of practical application of theoretical knowledge.	6#	CO1
I	2	Internship area Selection and Planning - Select internship area based on interests and skill sets, set objectives, define scope, and identify resources.	6#	CO1
I	3	Hands-On Internship Work - Work on selected area under the guidance of faculty mentor, provide regular feedback to mentor on progress of Internship and take guidance as needed.	30#	CO1

II	4	Participation in Training and Skill Enhancement - Participate in trainings/ conferences/ workshops/ competitions/ institutional laboratories work.	30#	CO2
III	5	Soft Skills Development - Attend sessions focused on developing essential soft skills such as communication, teamwork, and problem-solving, perfom role-playing exercises, group discussions, and interactive activities to enhance interpersonal skills.	18#	CO3
IV	6	Daily Diaries and Internship Report Preparation - Maintain daily diaries documenting their activities, challenges faced, and lessons learned during the internship.	10#	CO4
IV	7	Progress Review and Presentation Preparation - Compile internship experiences and outcomes into a comprehensive presentation, conduct practice sessions to refine presentation skills and ensure clarity and professionalism in delivery, Prepare internship report for submission to faculty mentors in prescribed format	10#	CO4
V	8	Internship Report Presentation - Present internship reports and Internship outcomes to faculty mentors and peers, Demonstrate presentation skills, technical knowledge, and Internship outcomes.	10#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. During the summer vacations, after the 2nd Semester, students are required to be involved in:
2. Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Continuing Education Department.
3. Contribution at incubation/ innovation /entrepreneurship cell of the institute.
4. Participation conferences/ workshops/ competitions etc.
5. Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop.
6. Working for consultancy/ research project within the institutes.
7. Join family business, (a declaration by a parent may be submitted directly to the Head of the Department.)

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Internship area	5
2	Work done and Feasibility of work	20
3	Report writing	15
4	Presentation Skills and Viva-Voce	10
	TOTAL	50

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	1	3	3	-	-
CO5	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Soft Skills: Enhancing Personal and Professional Success	Dr. Soma Mahesh Kumar, McGraw Hill, first edition, 2023	ISBN 13 - 978-9355325259
2	Communication Skills For Engineers	Muralikrishna and Sunita Mishra, Pearson Education India, Second Edition, 2011	ISBN 13 - 978-8131733844
3	AICTE Internship Policy: Guidelines & Procedures	All India council of Technical Education New Delhi	-

XV e-References:

1. https://internship.aicte-india.org/ assessed on 23rd April 2024
2. https://www.coursera.org/articles/computer-science-internships assessed on 23rd April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Desktop computers
2. Laser Printer
3. DLP

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M.B.Daigavane	Principal	Government Polytechnic, Nagpur
2	Dr. M. V. Sarode	HoD, Computer Engineering and I/C Trainining & Placement Officer	Government Polytechnic, Nagpur
3	Dr. G. V. Gotmare	I/C Curricullum Development Cell	Government Polytechnic, Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

GE Courses

Sem: III

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in ME/EE/EC/CM/IT/PK/MT/AE/MK/TX/AI
Course Category	:	GE
Course Code	:	CE291H
Course Title	:	Civil Engineering Practices

I Rationale:

The engineering students should know the facts, concepts, principles and procedures in civil engineering. This course describes the basic knowledge related to civil engineering. It is very useful course for the students to visualize the Civil Engineering structures which helps to engineering students in their professional and personal life.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use basic engineering Knowledge to solve the problems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** different types of buildings and their components.

CO2: **Identify** tools and Equipment used in construction activity.

CO3: **Identify** different components of Civil Engineering structures like Roads, Bridges, Railway Track.

CO4: **Identify** various components of Irrigation structures.

CO5: **Draw** flow diagram showing components of Water Supply Scheme & STP.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Building Construction	1a	Identify the components of building with its function.	1.1	Components of Building - Foundation, Column, Beam, Plinth, DPC, Sill, Lintel, Chajja, Slab, Doors, Windows, Parapet, Stair.	CO1
	1b	Select the type of equipment for a given situation.	1.2	Tools & Equipments used - Hand tools; screwdrivers, brushes, trowels, wrenches, knives, crimpers, clamps, Trolleys etc. Power tools: Concrete mixers, saws, cutters, drills, grinders, guns, breakers, Concrete lift, vibrater, tower crane etc.	
	1c	Compare between load bearing and frames structure with given parameters.	1.3	Load bearing structures - Definition, Its components and use. Framed structure - Definition, Its components and use.	
/s	2a	Classify the roads.	2.1	Classification of roads (Nagpur plan and Lucknow plan), Urban Roads.	

UNIT II: Highway	2b	Identify the given cross section of road and its componenets.	2.2	Cross section of road showing its component as per IRC. Road margin, road formation, right of way, Kerbs.	CO2
	2c	Select the type of road in given situation.	2.3	Various technical terms- Camber, super elevation, curves, pavements and its types, road intersections.	
UNIT III: Bridge and Railway	3a	Identify the components of bridge with its functions.	3.1	Bridge - Definition, Component of Bridge and its function. Classification of bridges.	CO3
	3b	Mention the importance of given basic terms in bridge engineering	3.2	Basic terms: Scour, Afflux, Runoff, Economic Span, Clearance, and Freeboard.	
	3c	Mention the importance of given basic terms in bridge engineering	3.3	Rail track cross sections – standard cross section of Broad Gauge (BG) and Meter Gauge (M.G), Single and double line in cutting and embankment. Metro rail and Mono Rail – types, factors affecting selection.	
	3d	Select a rail gauge to be used under given situation with justification.	3.4	Component parts of Permanent ways - rails, sleepers, rail joints, ballast and fixtures.	
: Irrigation Engineering	4a	Justify the Scope and development of irrigation in India.	4.1	Definition of irrigation Concept, Necessity, Scope and development of irrigation in India. Hydrological Cycle, Types of irrigation schemes, single & multipurpose projects.	CO4
	4b	Classify irrigation scheme for given condition.	4.2	Crops and cropping seasons in Maharashtra- Kharif, Rabi, Hot weather & Perennial.	

UNIT IV	4c	Draw a labeled sketch of dams for given condition	4.3	Dams and its classification- Gravity and Earthen dams, their components, Bandhara, weirs, Barrages, Sprinkler and drip irrigation.	
UNIT V: Public Health Engineering	5a	Identify the impurities present in water and it's classification.	5.1	Surface and subsurface sources of water, water borne diseases, Impurities present in water and it's classification.	CO5
	5b	Identify the given units of water treatment plant.	5.2	Treatment of water, various units in Water Treatment Plant (WTP) and their function	
	5c	Identify the given units of sewage treatment plant and house drainage system.	5.3	House drainage system, sanitary fittings, Generation of wastewater. Treatment of waste water, its units and their functions.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the various components of buildings with sketches / images.	02#	CO1
I	2	Prepare a report on tools and Equipment used in construction activity.	02#	CO2
I	3	Identify Load Bearing & Framed structures in the vicinity of area and prepare a report.	02#	CO1
II	4	Sketch the labeled cross section of roads mentioning various components and elements.	02#	CO3
II	5	Identify various types of roads in your area and prepare a report.	02#	CO3
III	6	Draw the labeled sketch of bridge mentioning functions of component parts.	02#	CO3
III	7	Identify various types of bridges in your area and prepare a report.	02#	CO3
III	8	Draw a labeled sketch of Railway Track mentioning the function of components.	02#	CO3
III	9	Identify various types of railway tracks in your area and prepare a report.	02#	CO3
IV	10	Identify various crops and cropping seasons in your area and prepare a report.	2	CO4
IV	11	Draw the sketches of various types of Dams with their circumstances .	02#	CO4
IV	12	Prepare a report on various methods of Irrigation.	02#	CO4
V	13	Draw flow diagram of water supply scheme & identify the various processes involved in it.	02#	CO5
V	14	Prepare a report on House drainage system.	02#	CO5
V	15	Draw flow diagram of sewage treatment plant & identify the various processes involved in it.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. NIL

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Building Construction	6	C	04	04	04	12
			O	00	00	00	0
2	Highways	6	C	04	04	04	12
			O	00	00	00	0
3	Bridge and Railway	6	C	04	06	06	16
			O	00	00	00	0
4	Irrigation Engineering	6	C	04	06	06	16
			O	00	00	00	0
5	Public Health Engineering	6	C	02	06	06	14
			O	00	00	00	0
Total		30	C	18	26	26	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q1 to Q35	1R2	1R2	1U2	1U2	1A2	1A2	2R2	35/35	
	2R2	2U2	2U2	2A2	2A2	3R2	3R2		
	3U2	3U2	3U2	3A2	3A2	3A2	4R2		
	4R2	4U2	4U2	4U2	4A2	4A2	4A2		
	5R2	5U2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance / Observation	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	-	2	3	-	-
CO2	-	-	-	-	-	2	3	-	-
CO3	-	-	-	-	2	2	3	-	-
CO4	-	-	-	-	2	2	3	-	-
CO5	-	-	-	-	3	2	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Building Construction	Rangwala, Charotar Publishing House Pvt. Ltd., 33rd Edition,2015	978-93-85039-04-1
2	Transportation Engineering	V.N.Mittal, Arvind Mittal, McGraw Hill Education Pvt. Ltd, Reprint, 2011	13: 978-0-07-059357-2
3	Irrigation Engineering	S.K.Bhattacharya and K.M.Rastogi., New Age International Publisher, Reprint, 2009.	978-81-224-1042-6
4	Environmental Engineering	S.G.Tarnekar and P.K.Kharbanda, S.Chand& Company Ltd., Third, 1990	13: 978-8121901048
5	Civil Engineering Through Objective Type Questions.	Gupta S. P. 4th Ed.	ISBN-10 : 8123907974 13 : 978-8123907970

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1. https://www.sanfoundry.com/1000-basic-civil-engineering-questions-answers/#google_vignette.Accessed on 24 May 2024.
2. https://www.grabstudy.com/Civil/Civil-Engineering.php. Accessed on 24 May 2024.
3. https://www.scribd.com/document/369866732/100-Civil-Engineering-Objective-Type-Questions. Accessed on 25 May 2024.
4. https://www.researchgate.net/publication/355183897_CIVIL_ENGINEEING_OBJECTIVE_TYPE_QUESTIONS_AND_ANSWERS_FOR_COMPETITIVE_EXAMS. Accessed on 25 May 2024.

XVI List of Major Equipment/Machineries with Specification:

1. Models of building components.
2. Models of roads.
3. Models of bridges.
4. Models of Irrigation structures.
5. Models of Water and sewage treatment.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	Head, Civil Engineering	Government Polytechnic, Nagpur
2	Mr. R. M. Walke	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur
6	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/EE/EC/AE/CM/IT/MK/AI/TX/PK/MT
Course Category	:	GE
Course Code	:	ME291H
Course Title	:	Elements of Mechanical Engineering

I Rationale:

This course is generic elective course. This course describes elementary knowledge related to mechanical engineering, which are commonly used in any discipline of Engineering & Technology. This course will help the students to gain the basic knowledge of mechanical tools,power transmission ,brakes,bearing, boiler, I. C. Engine ,refregeration and air coditioning which will be helpful to them when they will go to the world of work.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of Mechanical Engineering.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the components of transmition systems.

CO2: **Interpret** the working of braking systems and bearing.

CO3: **Recognize** the Engine parts and working of I.C.Engines.

CO4: **Interpret** the working of boilers along with their mountings and accessories

CO5: **Use** proper maintenance tools according to the situaion

CO6: **Interpret** the working of refrigeration and air conditionig.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Power Transmission	1a	Suggest the application of given type of Belt drive.	1.1	Flat belt, V- belt, timing belt and its advantages & applications.	CO1
	1b	Suggest the application of given type of drive.	1.2	Chain drives, Rope drive Advantages & Disadvantages and applications.	
	1c	Justify the application of given type of Gear Drives.	1.3	Spur gear terminology, types of gears and gear trains, their selection for different application.	
UNIT II: Brakes and Bearings.	2a	Identify the application of different types of brakes.	2.1	Function of brakes ,types of brakes, Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake. Various application of brakes.	CO2
	2b	Choose the proper Bearings for different conditions.	2.2	Bearings types - i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot.	

UNIT III: Internal Combution Engines	3a	Justify the need of given IC Engine .	3.1	Internal combustion engine: Necessity, Components and terminologies of I.C.engine . Classification & Fuels used for I.C. Engines, Applications of I.C. Engines.	CO3
	3b	Justify the use of given IC Engine for particular application.	3.2	Construction, working principle & applications of Two stroke & four stroke engines. (Petrol & Diesel).	
	3c	Compare given types of engines on the basis of given parameters.	3.3	Comparison between : i)Two stroke & Four stroke engine ii)S.I. Engine & C.I. Engine.	
UNIT IV: Boilers.	4a	Classify given types of boiler.	4.1	Classification of boilers fire tube boiler , water tube boiler advantages disadvantages.	CO4
	4b	Identify the different boiler Mountings and accessories.	4.2	Boiler Mountings and Accessories(Sketch, location and function).	
	4c	Identify the parts of La-Mount Boiler, Benson Boiler.	4.3	Construction and working of La-Mount Boiler, Benson Boiler.	
UNIT V: Maintenance Tools	5a	Compare given type of tools on given points.	5.1	Cutting tools- files, drills, chisels, hacksaws- their types, specifications, applications & precautions while handling.	CO5
	5b	Justify the application of given maintenance tool.	5.2	Hammering tools- hammers, mallets- their types, specifications, applications & precautions while handling.	
	5c	Illustrate given maintenance tools with sketches.	5.3	Maintenance tools- screw drivers, pliers, spanners, wrenches- their types, specifications, applications & precautions while handling.	
	5d	Identify the given Pneumatic tools.	5.4	Principle of working of Pneumatic tools, pneumatic tools like pneumatic drill and screw driver, air impact wrench, pneumatic staple gun,grease gun,brad nailer.	

	5e	Identify the given fasteners.	5.5	Fasteners (Nut, Bolt & Screws), their use and specification.	
UNIT VI: Refrigeration and Air conditioning System.	6a	Classify given type of Refrigeration system.	6.1	Clasification of Refrigeration system, vapour compresion system, Air absortion system. Construction and working of vapour compresion refrigeration system.	CO6
	6b	Identify application of Refrigeration system.	6.2	Various application of refrigeration in indusries.	
	6c	Identify the different components of air conditioning system.	6.3	Requirements of air conditioning systems.Working of Compressor,condenser, Expansion valve, Evaporator.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify various drives used in transmission system.	2#	CO1
II	2	Identify various types of brake.	2#	CO2
II	3	Identify various types of bearing.	2	CO2
II	4	Identify the parts of internal exponding brake.	2#	CO2
II	5	Identify the parts of disc brake .	2#	CO2
III	6	Identify the parts of I.C.Engine and run it.	2	CO3
III	7	Identify the parts of S.I..Engine and run it.	2#	CO3
III	8	Identify the difference between S.I. and C.I.Engine.	2#	CO3
IV	9	Identify the various type of boilers.	2#	CO4
IV	10	Identify various mountings of boiler.	2#	CO4
IV	11	Identify the parts of La-Mount Boiler.	2	CO4
V	12	Identify Fasteners (Nut, Bolt & Screws) and write its specifications.	2#	CO5
V	13	Identify various Cutting tools- files, drills, chisels, hacksaws- their types and write its specifications.	2#	CO5
VI	14	Identify different components of air conditioning systems.	2#	CO6
VI	15	Identify various components of vapour compression refrigeretion system.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Power Transmission	4	C	02	04	04	10
			O	00	00	00	0
2	Brakes and Bearings.	6	C	04	04	04	12
			O	00	00	00	0
3	Internal Combution Engines	6	C	02	04	06	12
			O	00	00	00	0
4	Boilers.	4	C	02	04	04	10
			O	00	00	00	0
5	Maintenance Tools	6	C	02	04	06	12
			O	00	00	00	0
6	Refrigeration and Air conditioning System.	6	C	04	06	04	14
			O	00	00	00	0
Total		32	C	16	26	28	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 1 to Q. 35	1R2	1U2	1U2	1A2	1A2	2R2	2R2	35/35
	2U2	2U2	2A2	2A2	3R2	3U2	3U2	
	3A2	3A2	3A2	4R2	4U2	4U2	4A2	
	4A2	5R2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing and selection of equipment.	5
2	Writing procedure.	10
3	Working of equipment.	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	1	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	1	-	-	1	-	-
CO6	3	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Elements of Workshop Technology-vol.1	S.K. Hajra Choudhary, A.K. Hajra Choudhary, Media Promotors & Publishers Pvt. Ltd., Mumbai.	13: 9780906216019
2	Mechanisms and Mechanical Devices	Neil Sclater, Mc-Graw Hill Education.	13: 9780071704427
3	A Textbook Of Thermal Engineering	R.S. Khurmi, J.K. Gupta, S. Chand & Company Ltd., New Delhi.	13: 9788121925730
4	Refrigeration and Air conditioning	R. S. Khurmi, S.Chand & Company Pvt. Ltd	13: 9788121927819

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2. https://www.youtube.com/watch?v=qbyL--6q7_4, accessed on 25th May, 2024

XVI List of Major Equipment/Machineries with Specification:

1. Different types of belt
2. Different types of gears.
3. Different types of chain.
4. Model of shoe brake
5. Internal expanding brake
6. I.C.Engine test rig.
7. Boiler model
8. Mechanical tools, fasteners.
9. Refregeration test rig.
10. Air conditioning test rig.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr.S.R. Kaduskar	I/C HOD Mechenical Engg. Department	Government Polytechnic, Nagpur
2	Mr.N.J. Burbure	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
3	Mr.N.E. Pise	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
4	Dr.M.M. Pawade	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
5	Mr.A.R. Sheikh	Director	A.R.Automation, Jafer Nager, Nagpur
6	Mr.G.F. Potbhare	Principal	NIT Polytechnic, Nagpur
7	Mr.G.H. Dahole	I/C HOD Mechenical Engg. Department	Government Polytechnic, Gondia.

(Mr. S. R. Kadusksr)
HOD & Chairman PBOS, ME

(Dr. G. V. Gotmare)
Member Sectretary PBOS, ME

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EC/CM/IT/AI/PK/MT/MK/TX/AE
Course Category	:	GE
Course Code	:	EE291H
Course Title	:	Electrical Generation, Transmission and Distribution

I Rationale:

This NEP-aligned multidisciplinary elective course equips diploma engineering students with essential knowledge in electrical engineering, covering fundamental concepts, principles, and procedures. It includes the basics of electrical generation, transmission, and distribution. This course offers a comprehensive foundation, fostering a well-rounded understanding crucial for various engineering disciplines, in line with the NEP's vision for holistic and interdisciplinary education.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of basic electrical engineering.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** basic laws of Electrical Engineering to solve basic DC circuits.

CO2: **Measure** various electrical quantities in AC circuit.

CO3: **Identify** various system in electrical power generation.

CO4: **Identify** various components in electrical power trasnmission system.

CO5: **Identify** various components in electrical distribution system.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
T I: Fundamentals of Electricity.	1a	Differentiate between given electrical parameters.	1.1	Concept of electric charge, current, voltage drop, EMF, potential difference, direction of current and their SI units. Resistance, unit of resistance, law of resistance (Factors affecting resistance), Effect of temperature on resistance, Ohms law.	CO1
	1b	Solve given electric circuit.	1.2	Resistance in series and parallel, properties of series circuit and parallel circuit, voltage distribution in series circuit, Current distribution in parallel circuit, equivalent resistance of series circuit, equivalent resistance of parallel circuit. Applications of series circuits and parallel circuits. Kirchhoff's current and voltage law.	

UNI	1c	Suggest the measuring instrument for measuring given electrical quantity.	1.3	Work, power, energy and their SI units, Relation between H.P and watts, Kwh and Kcal. Connection of ammeter, voltmeter and wattmeter in single phase AC circuit and its measurement.	
	1d	Compare given supply on a given parameter.	1.4	Concept of AC and DC supply comparison between AC and DC supply.	
UNIT II: AC Fundamentals	2a	Compare the given generation on basis of given points.	2.1	Generation of alternating voltage- single phase and three- phase.	CO2
	2b	Identify the different terminologies related to AC supply.	2.2	Equation of sinusoidal alternating voltage and current, important terminology such as- waveform, instantaneous value, cycle, time period, frequency, amplitude, Relation between time period and frequency, angular velocity and frequency, frequency and speed. Maximum, average and R.M.S. value of sinusoidal waveform, form factor and peak factor.	
	2c	Compare the given types of loads.	2.3	AC voltage applied to pure resistor, pure inductor, and pure capacitor. Concept of reactance, impedance and power factor, power in single phase circuit.	
	2d	Classify the different types of induced electromotive force.	2.4	Faraday's laws of electro-magnetic induction, Basic construction of transformer, Lenz's law, Fleming right hand rule, Induced EMF, statically induced EMF, dyanamically induced EMF, self-inductance, mutual-inductance.	
	2e	Compare the different types of induced EMF.	2.5	Dynamically and statically induced EMF, self and mutual induced Electromotive force and its inductances.	

UNIT III: Electrical Power Generation	3a	Identify the blocks of given power plants.	3.1	General layout, working and site selection of thermal power plant, hydroelectric power plant and nuclear power plant.	CO3
	3b	Identify different types of renewable energy sources.	3.2	Renewable energy sources- Solar Energy, wind Energy and its block diagram.	
	3c	Compare given power stations on the basis of given points.	3.3	Comparison between different generating stations with respect to sources of energy, site, initial cost, and running cost, pollution, efficiency, maintenance and stand by losses.	
UNIT IV: Electrical Power Transmission	4a	Classify transmission line on basis of given data.	4.1	Need of high voltage line, classification of transmission lines: on the basis of voltage and line length, single line diagram.	CO4
	4b	Compare different types of conductors.	4.2	Transmission Line Parameters, types of conductors (single and double circuits - solid, stranded and bundled conductors)	
	4c	Identify different effects related to transmission line.	4.3	Skin effect, Ferranti effect and Proximity effect.	
	4d	Suggest suitable components of given transmission line.	4.4	Conductors- desirable properties, types- copper, all aluminum (AAC), all-aluminum alloy. Line insulators: desirable properties of insulator materials, selection of material, types of insulators (For transmission and distribution lines), applications, causes of insulator failure.	
uition.	5a	Identify the different component of distribution line.	5.1	Introduction, feeders, distributor and service lines. Construction of overhead distribution lines, earth wire, guarding.	

UNIT V: Electrical Power Distrib	5b	Classify different distribution schemes on basis of given points.	5.2	Primary distribution systems & Secondary distribution systems, Types of different distribution schemes: Radial, ring mains and grid, layout, advantages, limitations & applications.	CO5
	5c	Identify given components of substation.	5.3	Introduction, classification of substations according to service & location, typical single line connection diagrams of substation layouts, 11 KV/0.415 KV pole mounted distribution substation.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Connect voltmeter, ammeter and wattmeter in electrical circuit.	2#	CO1
I	2	Measure the current, voltage and resistance with the help of multi-meter or tong tester.	2#	CO1
I	3	Calculate unknown resistance of DC series and parallel circuits.	2#	CO1
I	4	Calculate unknown parameter in electrical circuit using KCL & KVL.	2#	CO1
II	5	Calculate transformation ratio of single phase transformer.	2#	CO2
II	6	Find current response of pure resistive/ inductive/ capacitive circuit.	2	CO2
II	7	Measure power in single phase AC circuit.	2#	CO2
III	8	Identify the parts of nuclear fired thermal power plant after watching a video programme.	2#	CO3
III	9	Identify the parts hydroelectric power plant after watching a video programme.	2	CO3
III	10	Draw a schematic of micro hydro power plant.	2#	CO3
III	11	Identify the different components of solar PV system.	2#	CO3
IV	12	Identify different types of transmission and distribution line supports. Prepare report and draw it on sketch book.	2#	CO4
IV	13	Identify different types of overhead line insulators. Prepare report and draw it on sketch book.	2#	CO4
V	14	Prepare a visit report of 132 KV substation.	2	CO5
V	15	Prepare a visit report of 11 KV substation.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Fundamentals of Electricity.	4	C	02	04	04	10
			O	00	00	00	00
2	AC Fundamentals	6	C	02	06	04	12
			O	00	00	00	00
3	Electrical Power Generation	6	C	04	06	06	16
			O	00	00	00	00
4	Electrical Power Transmission	7	C	04	06	06	16
			O	00	00	00	00
5	Electrical Power Distribuition.	7	C	04	06	06	16
			O	00	00	00	00
Total		30	C	16	28	26	70
			O	00	00	00	00

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 01 to Q.35	1R2	1U2	1U2	1A2	1A2				35/35
	2R2	2U2	2U2	2U2	2A2	2A2			
	3R2	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	4R2	4R2	4U2	4U2	4U2	4A2	4A2	4A2	
	5R2	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	1	-	-	1	-	-
CO2	3	-	-	1	-	-	1	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Text Book on Laboratory Courses in Electrical Engineering	S.G.Tarnekar and P.K.Kharbanda, S.Chand & Company Ltd., Third, 1990	13: 978-8121901048
2	A Textbook of Electrical Technology Vol-I	B.L.Theraja, A.K.Theraja, S.Chand & Co Ltd., Reprint, 2006	10: 81-219-2440-5
3	Generation Of Electrical Energy	B.R.Gupta, Eurasia Publishing House (Pvt.) Ltd, Third Edition, 1996.	10: 81-219-0102-2
4	Principles Of Power System	V.K. Mehta, S.Chand & Co.Ltd, Reprint, 1996.	10: 81-219-0594-X

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5. https://www.youtube.com/watch?v=A9sRsIghUxY ,accessed on 10th May , 2024
6. https://library.automationdirect.com/basic-electrical-theory/ , accessed on 10th May , 2024

XVI List of Major Equipment/Machineries with Specification:

1. Ammeter MI 0-5-10
2. Voltmeter MI 0-150-300 V
3. Wattmeter 0-1000 W
4. Digital Multi-meter 3 ½ digits
5. Single phase auto transformer 0-240 Volts, 16A
6. Rheostat assorted sizes 10 Ohm, 50 Ohm

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M. B. Daigavane	Principal	Government Polytechnic, Nagpur
2	Dr. P. M. Daigavane	HOD, Electrical Engineering	G.H.Raisoni College of Engg, Nagpur
3	Mrs. Divya Piparode	Sr. Engineer	Powergrid Corporation of India Ltd. Nagpur
4	Mr. M. N. Gawande	Lecturer in Electrical Engineering	Government Polytechnic, Gondia
5	Dr. G. V. Gotmare	I/C HOD, Electrical Engineering	Government Polytechnic, Nagpur
6	Mr. A. P. Dasarwar	Lecturer, Electrical Engineering	Government Polytechnic, Nagpur

(Mr. M. C. Musale)
HOD & Chairman PBOS, EE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, EE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/CM/IT/PK/AI/MT/MC/AE/TX
Course Category	:	GE
Course Code	:	EC291H
Course Title	:	Analog and Digital Electronics

I Rationale:

Analog and Digital Electronics form the foundation of modern electronic systems. Analog electronics deals with continuous signals and voltage levels, while digital electronics focuses on discrete signals and binary numbers. Students learn about to integrate analog and digital circuits to create electronic systems that meet specific requirement. Analog and Digital Electronics interface with various engineering disciplines. Students develop a multidisciplinary approach to problem solving and gain knowledge about electronic devices.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of electronic components and circuits.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** given type of active and passive components for specific application.

CO2: **Choose** appropriate type of rectifier and filter.

CO3: **Select** given type of operational amplifiers.

CO4: **Implement** the basic logic gates using universal gates.

CO5: **Use** combinational and sequential logic circuits.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Active and Passive Components	1a	Identify the components from given types of components.	1.1	Active components - Definition and types, Passive components Definition and types	CO1
	1b	Classify the given types of passive components.	1.2	Passive components- Symbol, properties and applications of resistor, capacitor and inductor. Types of Resistors, Types of Capacitors, Types of Inductor	
	1c	Select given type of active component as per application.	1.3	Active components - Symbol of Diode and transistor. Diodes - Introduction and symbol of PIN diode, Varactor diode, Tunnel diode, Zener diode, LED a Photo diode.	
	1d	Interpret the working of given PN junction diode.	1.4	Diodes - Basic construction of PN junction diode, formation of PN junction, Depletion layer, Advantages, Disadvantages and applications.	

	1e	Choose given type of transistor.	1.5	Transistor - Basic construction of NPN and PNP transistor, Working principle, Advantages, Disadvantages and applications.	
UNIT II: Rectifiers and Filters	2a	Classify given type of rectifier.	2.1	Definition of rectifier.Types of rectifier–Half wave rectifier, Full wave center tapped rectifier, Full wave bridge rectifier.	CO2
	2b	Draw input and output waveforms of given rectifier.	2.2	Half wave rectifier– Circuit diagram, Waveforms, working principle, advantages and disadvantage.	
	2c	Choose given type of full wave rectifier as per requirement.	2.3	Full wave rectifier- Circuit diagram, Waveforms, working principle, advantages and disadvantages of center-tapped full wave rectifier and full wave bridge rectifier.	
	2d	Illustrate the working principle of given filter.	2.4	Definition and types of filter. Filters- Circuit diagram and working principle of series inductor, shunt capacitor, LC filter, PI filter.	
UNIT III: Operational Amplifiers	3a	Identify given symbol of operational amplifier.	3.1	Introduction to Op-amp, OP-amp symbol and terminals, Equivalent circuit.	CO3
	3b	Interpret the pin diagram and functions of given op-amp I.	3.2	Operational amplifier IC 741 – Pin diagram and pin function.	
	3c	Illustrate the working of given block diagram.	3.3	Block diagram of Operational amplifier and function of all stage.	
	3d	Select given type of operational amplifiers.	3.4	Circuit diagram and working principle of Inverting amplifier and Non Inverting amplifier.	
	3e	Select operational amplifier for given applications	3.5	Circuit diagram and working principle of Adder and subtractor	
: Gates	4a	Compare analog and digital systems on given points.	4.1	Introduction to digital signal, Advantages of Digital System over analog systems.	

UNIT IV: Number System and Logic	4b	Differentiate given number systems.	4.2	Number Systems: Different types of number systems Decimal, Binary, Octal, Hexadecil.	CO4
	4c	Identify given logic gates.	4.3	Logic gates: Basic gates – AND, OR, NOT gate. Derived Gates – NAND, NOR, EX- OR, EX-NOR gate.	
	4d	State the De Morgan's theorems.	4.4	De Morgan's theorems. Statement and Proof.	
	4e	Implement given basic logic gate using universal gates.	4.5	Universal Gates: NAND and NOR as Universal gate. Implementation of basic logic gates using NAND an NOR gate.	
UNIT V: Combinational and Sequential Circuits	5a	Design given K-maps.	5.1	Karnaugh Map representation of Logic Functions using Truth table (2 variables, 3 variables, 4 variables) Canonical SOP and POS and Don't Care condition.	CO5
	5b	Illustrate the working of given multiplexer and demultiplexer.	5.2	Multiplexers (MUX) and De-multiplexer (DEMUX): Block diagram, truth table, logic expression and logic diagram of 2:1, 4:1 MUX and 1:2,1:4 DEMUX.	
	5c	Distinguish given flip flops.	5.3	Flip Flops - S R Flip flop, JK flip flop, D-Type flip-flop, T-Type flip flop (Block diagram, truth table and logical expression and application.	
	5d	Select given shift register for specific applications.	5.4	Introduction to Registers, Types of Shift Registers, Applications of Shift register.	
	5e	Classify given types of counter.	5.5	Classification and applications of counter.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify various active and passive components.	2#	CO1
I	2	Test resistor, capacitor and inductor using digital multimeter and LCR-Q meter	2#	CO1
I	3	Test PN junction diodes using digital multimeter.	2#	CO1
I	4	Test transistors using digital multimeter.	2	CO1
II	5	Build the half wave rectifier circuit on breadboard and draw input-output waveforms.	2#	CO2
II	6	Build the full wave bridge rectifier circuit with PI filter on breadboard and draw input-output waveforms.	2#	CO2
III	7	Build inverting amplifier circuit on breadboard and observe input-output waveforms on CRO.	2#	CO3
III	8	Build non-inverting amplifier circuit on breadboard and observe input-output waveforms on CRO.	2#	CO3
IV	9	Test the behaviour of different logic gates by using truth table.	2#	CO4
IV	10	Assemble various basic gates using universal gates and relate it with truth table.	2#	CO4
V	11	Build and test the functions of MUX IC 74151.	2#	CO5
V	12	Build and test the functions of DEMUX IC 74155.	2#	CO5
V	13	Construct and test functions of D flip flop using IC 7476.	2#	CO5
V	14	Construct and test functions of T flip flop using IC 7476.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Active and Passive Components	6	C	04	04	04	12
			O	0	0	0	0
2	Rectifiers and Filters	5	C	02	08	04	14
			O	0	0	0	0
3	Operational Amplifiers	6	C	02	08	04	14
			O	0	0	0	0
4	Number System and Logic Gates	6	C	04	06	04	14
			O	0	0	0	0
5	Combinational and Sequential Circuits	7	C	02	08	06	16
			O	0	0	0	0
Total		30	C	14	34	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
1	1R2	1R2	1U2	1U2	1A2	1A2	2R2	35/35
2	2U2	2U2	2U2	2U2	2A2	2A2	3R2	
3	3U2	3U2	3U2	3U2	3A2	3A2	4R2	
4	4R2	4U2	4U2	4U2	4A2	4A2	5R2	
5	5U2	5U2	5U2	5U2	5A2	5A2	5A2	
6								

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Drawing circuit diagram, selection of equipment	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	3	-	-
CO2	3	-	-	3	-	-	3	-	-
CO3	3	-	-	3	-	-	3	-	-
CO4	3	-	-	3	-	-	3	-	-
CO5	3	-	-	3	-	-	3	-	-
CO6	3	-	-	3	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Principles of Electronics	V. K. Mehta, S. Chand & Company Ltd., Reprint, 1996	10: 8121910536
2	Electronic Principles	A.P. Malvino, Tata McGraw Hill, 8th edition	13: 9780073373881
3	Applied Electronics	R. S. Sedha, S. Chand & Co, revised edition, 2013	10: 8121927838, 13: 97881219 27833
4	Digital Integrated Electronics	Herbert Taub (Author), Donald L. Schilling, McGraw-Hill Inc, 1977	10: 0070857881 13: 9780070857889
5	Digital Principles and Application	Malvino, Albert Paul; Leach, Donald P., Mcgraw-Hill, 1986	10:0070398836 13: 9780070398832
6	Modern Digital Electronics	R.P.Jain, McGraw Hill Education (India) Private Limited, 2009	10: 0070669112 13: 9780070669116

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6. www.electrical4u.com/digital-electronics , accessed on 25th May 2024.
7. http://nptel.ac.in/courses/108108076/1 , accessed on 25th May 2024.
8. http://www.electrical4u.com , accessed on 25th May 2024.
9. https://www.youtube.com/watch?v=A9KSGAnjo2U, accessed on 25th May 2024.

XVI List of Major Equipment/Machineries with Specification:

1. Digital Multi-meter.
2. Cathode ray oscilloscope- 0 to 30MHz.
3. Function Generator–0-5MHz.
4. Regulated Power Supply - 0-30 V
5. Photodiode, Varactor diode, Tunnel diode, Zener diode.
6. Logic Gates ICs (7400,7402,7404,7408,7432,7486)
7. Multiplexer and De multiplexer IC (74150,74151,74138,74139)
8. Flip Flops ICs (7472,7474,74H71,74L71)
9. Breadboard and LEDs

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	HOD, Electronics & Telecomm. Engg.	Government Polytechnic, Nagpur
2	Dr. V. H. Mankar	HOD, Electronics & Telecomm. Engg.	Government Polytechnic, Nagpur
3	Mrs. R.R.Vairagade	Lecturer, Electronics & Telecomm. Engg	Government Polytechnic, Nagpur
4	Mrs. J.A.Raut	Lecturer, Electronics & Telecomm. Engg	Government Polytechnic, Nagpur
5	Mr. Sandeep V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
6	Dr. V. J. Dongre	HOD, Electronics & Telecomm. Engg.	Government Polytechnic, Arvi
7	Prof. Mrs. Gazala Ali	HOD, Electronics & Telecomm. Engg.	Anjuman Polytechnic, Nagpur

(Dr. R. V. Yenkar)
HOD & Chairman PBOS, EC

(Dr. G. V. Gotmare)
Member Secretary PBOS, EC

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/MT/MC/AE/TX
Course Category	:	GE
Course Code	:	IT291H
Course Title	:	Applied Multimedia Techniques

I Rationale:

Multimedia provides the benefit of interactive learning. Multimedia is utilized in various fields including education, entertainment, communication, game design, and digital art, reflecting its broad impact on modern technology and media to create presentations and visualization extensively. This course aims to produce graduates with a versatile skill set, ready to tackle the challenges posed by multimedia-rich environments in various professional settings and also used in various fields like education, training, reference material, business presentations, advertising and documentaries.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use various multimedia tools and software for various application.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** variety of multimedia tools and software for image editing efficiently.

CO2: **Use** vector graphics to design various tools like 2D,3D rendering images and logos orderly.

CO3: **Apply** the skills of multimedia presentation software to create user interfaces for improved user experiences.

CO4: **Apply** multimedia techniques for data visualization, effectively communicating complex information through interactive elements.

CO5: **Apply** the multimedia concepts for capturing photographs to provide improved visualization.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction	1a	Select the steps to install the GIMP.	1.1	Introduction to GIMP, overview of the software, installation and setup.	CO1
	1b	Select the different tools available on GIMP workspace.	1.2	Exploring the workspace: toolbars, panels and navigation tools: shortcuts keys, navigation control and dialog.	
	1c	Select the uses of Layers based on given point.	1.3	Explore the layers, using the zoom and hand tools.	
	1d	Select the different basic Image adjustments on given parameter.	1.4	Basic image adjustments, removing backgrounds using selection tools: rectangle select, ellipse select and free select.	
	1e	Specify the Advanced Background Removal Techniques.	1.5	Advanced Background Removal Techniques, Cropping, Resizing, and Rotating Images.	

UNIT II: Vector Graphics	2a	Compare the given features of vector graphics on given point.	2.1	Introduction to vector graphics: raster image (gif, png, jpg) and vector image (svg).	CO2
	2b	Identify the basics of given vector graphics software.	2.2	Overview of Blender software and Inkscape software.	
	2c	Select the vector graphics tools on given point.	2.3	Vector graphics tools: points, lines, curves, and shapes.	
	2d	Create a vector graphics image on the basis of given parameter.	2.4	Vector graphics image creation: design, choose a tool, create shapes edit and modify, save and export.	
	2e	Select the given tools for vector graphics based on given point.	2.5	2D and 3D rendering design in vector graphics.	
UNIT III: Presentation Software	3a	Analyse the multimedia presentation software.	3.1	Introduction: ppt, canva managing slides, templates and presentations.	CO3
	3b	Apply the dependencies and libraries of ppt.	3.2	Enable dependencies and slide Library of ppt, macros, cascade, slide sorter.	
	3c	Choose the tools for the given presentation.	3.3	Design layout, browse for themes, background styles and insertion- charts, clipart, tools-textbox, header footer.	
	3d	Use animation techniques on given points.	3.4	Using custom animations-transition sound and speed, video and images.	
	3e	Create the given multimedia presentation.	3.5	Protect presentation, adding and managing comments.	
Video Editing	4a	Analyse the given Audio and video Editing softwares.	4.1	Introduction of Audio/video: Color correction, audio post-production, voice altering effects, text and image tracking.	
	4b	Use given softwares for Audio and video Editing.	4.2	Overview of Audacity, Adobe Audition, and OBS (Open Broadcaster Software).	

UNIT IV: Audio and V	4c	Apply the given techniques for Audio Editing.	4.3	Audio Editing Techniques: trimming, adjusting volume, adding sound effects, waveform editing.	CO4
	4d	Apply the given techniques for video Editing.	4.4	Video Editing Techniques: color correction, color grading, cutaways, cutting on action.	
	4e	Apply Audio/video Editing softwares on the basis of given softwares.	4.5	Applications of Audio/video Editing softwares: adobe premier rush, cyber link powerdirector 365.	
UNIT V: Photography with Camera	5a	Analyse the basics of photography and camera on given scenario.	5.1	Introduction to photography: basics photography, working of camera: light, focus, record, shutter, process,n store and view.	CO5
	5b	Analyse the given functions of camera for photography.	5.2	Functions of camera: capturing images, storing images, controlling image quality and controlling motion.	
	5c	Classify the given techniques of given multimedia photography.	5.3	Techniques of basic photography: composition, Aperture, background, exposure, Histogram.	
	5d	Apply the given photography modes on camera.	5.4	Basic photography modes: auto mode, manual mode, program mode.	
	5e	Apply the given advanced modes on camera.	5.5	Advanced camera modes: Shutter-priority mode, shutter speed, ISO, Macro mode.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Install GIMP and explore various tools for editing of images.	2#	CO1
II	2	Design simple logos or icons using vector graphics software like Blender or Inkscape.	2#	CO2
II	3	Create raster and vector images using vector graphics software like Blender or Inkscape.	2#	CO2
III	4	Create custom animation-based presentation using transition speed and sound, images, and videos.	2#	CO3
III	5	Develop a presentation based on given dependencies and Libraries of the software.	2#	CO3
III	6	Develop a layout using theme, background styles etc. tools.	2#	CO3
III	7	Develop a multimedia presentation using software like Canva etc.	2#	CO3
IV	8	Install the open broadcaster software and explore various tools of it for audio and video editing.	2#	CO4
IV	9	Use Audio and video techniques for editing using OBS.	2#	CO4
IV	10	Use Audio and video techniques for editing using Adobe premier-rush or Cyberlink powerdirector 365.	2#	CO4
V	11	Use different functions of digital camera or smartphone to take photographs.	2#	CO5
V	12	Apply different modes digital camera or smartphone to click photographs for multimedia purposes.	2#	CO5
V	13	Apply advanced camera modes to edit photographs.	2	CO5
V	14	Create animated presentation based on real-world application using all dependencies and libraries of Microsoft Powerpoint presentation.	2	CO5
V	15	Prepare multimedia project using canva software based on real-world scenario.	2	CO5

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction	6	C	02	04	04	10
			O	0	0	0	0
2	Vector Graphics	7	C	02	04	08	14
			O	0	0	0	0
3	Presentation Software	6	C	02	04	10	16
			O	0	0	0	0
4	Audio and Video Editing	6	C	02	04	10	16
			O	0	0	0	0
5	Photography with Camera	5	C	02	04	08	14
			O	0	0	0	0
6			C				0
			O				
Total		30	C	10	20	40	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
1	1R2	1U2	1U2	1A2	1A2	2R2	2U2	35/35
2	2U2	2A2	2A2	2A2	2A2	3R2	3U2	
3	3U2	3A2	3A2	3A2	3A2	3A2	4R2	
4	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
5	5R2	5U2	5U2	5A2	5A2	5A2	5A2	
6								

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Activities	5
2	Writing program	5
3	Performance / Execution of program	10
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-
CO5	3	-	-	3	-	-	1	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Adobe Photoshop CC Classroom in a Book	Andrew Faulkner and Conrad Chavez, Adobe Press, 2019	978-0-13-526178-1
2	Inkscape: Guide to a Vector Drawing Program	Tavmjong Bah, Prentice Hall, 4th Edition	978-0-13-276414-8
3	The Animator's Survival Kit: A Manual of Methods, Principles, and Formulas for Classical, Computer, Games, Stop Motion, and Internet Animators	Richard Williams, Faber & Faber	978-0-571-20228-7
4	Presentation Zen: Simple Ideas on Presentation Design and Delivery	Garr Reynolds, New Riders	978-0-321-52565-9
5	Understanding Exposure: How to Shoot Great Photographs with Any Camera	Bryan Peterson, Amphoto Books, 4th Edition	978-1-64051-114-0

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2. https://inkscape.org/learn/tutorials/, accessed on 12th Feb 2024
3. https://www.animationmentor.com/free-maya-basic-animation-tutorials/, accessed on 12th Feb 2024
4. https://www.canva.com/designschool/, accessed on 12th Feb 2024
5. https://obsproject.com/kb/quick-start-guide, accessed on 12th Feb 2024
6. https://www.blender.org/support/tutorials/, accessed on 12th Feb 2024
7. https://www.gimp.org/tutorials/, accessed on 12th Feb 2024

XVI List of Major Equipment/Machineries with Specification:

1. Compuer latest version

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. R.Mahajan	HOD, Information Technology	Government Polytechnic, Nagpur
2	Mr. Dipak Dhote	Operations Manager	IT- Network, NAgpur
3	Dr. Rakesh Kadu	Assistant Professor, Information Technology	Ramdeobaba College of Engineering and Technology, Nagpur
4	Mrs. V. A. Raje	System Analyst	MSBTE, RO, Nagpur
5	Mrs. I. L. Sangolkar	Lecturer, Information Technology	Government Polytechnic, Nagpur
6	Mr.L.D.Vilhekar	Lecturer, Information Technology	Government Polytechnic, Nagpur

(Dr. A. R. Mahajan)
HOD & Chairman PBOS, IT

(Dr. G. V. Gotmare)
Member Secretary PBOS, IT

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/CM/IT/PK/AIML/MK/AE/TX
Course Category	:	GE
Course Code	:	MT291H
Course Title	:	Foundry Technology

I Rationale:

A Foundry Technology course equips diploma students in India with essential skills in casting and metalworking, crucial for the manufacturing sector. It bridges the gap between theoretical knowledge and practical application, fostering expertise in metal production, quality control, and industrial processes. This specialization meets the growing demand for skilled professionals in automotive, aerospace, and infrastructure industries, driving economic growth and technological advancement

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Perform casting and foundry operations

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Use** various patterns in foundry

CO2: **Construct** various core bores

CO3: **Construct** Moulds and Patterns for castings

CO4: **Perform** various tests on moulding sand to find its suitability in foundry applications

CO5: **Produce** castings of different metals/alloys for various applications

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: PATERN AND PATTERN MAKING	1a	Select suitable manufacturing process for given appliaction	1.1	Various manufacturing processes, Steps involved in Making a Casting. Advantages of metal casting, Applications of Metal Casting, Different sections of a Foundry, types of foundry Function of pattern, Difference between pattern and casting	CO1
	1b	Identify given ISI coloring code on pattern	1.2	various types of pattern materials. Types of patterns, Pattern allowances,Steps involved in pattern construction, ISI coloring code on pattern	
ORE AND CORE AKING	2a	Select proper core making machine for given application	2.1	Function of core, core applications, Core sand properties , Core sand ingredients	
	2b	Choose proper core sand ingredients for making of core	2.2	Core materials ,core sand mixture, Core making procedure , Types of core, Core prints	CO2

UNIT II: CO M	2c	Choose proper Core making machines for making of core	2.3	Core making machines, core baking and machining operations on cores,Core shifting and Chaplet, Core applications, Construction of core box	
UNIT III: MOULD AND MOULD MAKING	3a	Select proper moulding sand for mold making	3.1	Functions of mould, Mould materials-sand, binder, water, additives, etc Types of Moulding sands and their Properties	CO3
	3b	Sequece correct steps in sand preperation.	3.2	Moulding sand preparation and conditioning (a) objectives of sand preparation (b) Steps for sand preparation (c) Working of sand Muller	
	3c	Choose proper sand control test for mould making.	3.3	Sand control tests- (a) Moisture content test (b) Clay content test (c) Grain fineness test	
	3d	Select proper steps in mold making	3.4	Steps involved in mould making, mould making machines, Moulding methods, hand Moulding tools,venting of moulds. Mould -metal reaction	
UNIT IV: SOLIDIFICATION OF CASTINGS	4a	Identify given types of solidification	4.1	Concept of solidification of metals	CO4
	4b	Select proper gating system to obtain sound casting	4.2	GATING system: - function of each component of the gating system pressurized and unpressurised ,RISER - Function of risers, types of riser	
MELTING PRACTICE	5a	Select Furnaces for melting ferrous and non-ferrous metals.	5.1	Furnaces for melting ferrous and non-ferrous metals	CO5
	5b	Identify given Zones of Cupola	5.2	Cupola – Construction, Various operations, Zones of Cupola, Crucible furnaces-types, working principle, advantages, disadvantages and applications	

UNIT V:	5c	Select proper post casting operation to get sound casting in foundry	5.3	Heat treatment of Castings-Stress Relieveing, Post casting operations: Fettling

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify various Foundry tools	2#	CO1
I	2	Identify various furnances used for melting operation	2#	CO1
II	3	Identify patterns for casting opertaion	2#	CO2
II	4	Identify moulds for casting opertaion	2#	CO2
III	5	Identify core boxes for making of castings	2#	CO3
III	6	Determine Moisture content in Moulding sand by Infra-red bulb method	2#	CO3
IV	7	Determine the amount of clay content in moulding sand..	2#	CO4
IV	8	Determine A.F.S. fineness No. of sand	2#	CO4
IV	9	Identify given metal scrap for melting operation	2#	CO4
IV	10	Perform melting operation for given metal/ alloys	2	CO4
V	11	Prepare proper molding sand by mixing , screening and sieving of given sand	2#	CO5
V	12	Colour given patterns as per ASTM colour coding	2#	CO5
V	13	Choose proper gating and risering system for given mould	2#	CO5
V	14	Select suitable post casting operation for finishinf of casting	2	CO5
V	15	Identify defects occured in casting	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	PATERN AND PATTERN MAKING	2	C	04	04	06	14
			O	00	00	00	0
2	CORE AND CORE MAKING	4	C	04	04	0 0	8
			O	00	00	00	0
3	MOULD AND MOULD MAKING	4	C	02	04	06	12
			O	00	00	00	0
4	SOLIDIFICATION OF CASTINGS	10	C	04	08	06	18
			O	00	00	00	0
5	MELTING PRACTICE	10	C	04	08	06	18
			O	00	00	00	0
6			C	00	00	00	0
			O	00	00	00	0
Total		30	C	18	28	24	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	
1	1R2	1R2	1U2	1U2	1A2	1A2	1A2	35/35	
2	2R2	2R2	2U2	2U2	3R3	3R3	3R3		
3	3A2	3A2	3A2	4R2	4R2	4U2	4U2		
4	4U2	4U2	4A2	4A2	4A2	5R2	5R2		
5	5U2	5U2	5U2	5U2	5A2	5A2	5A2		
6									

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing diagram, selection of equipment & tools. writing	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	
CO4	3	-	-	3	-		-	-	-
CO5	3	-	-	3	-	1	-	-	-
CO6	3	-	-	3	-		-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Text Book of Foundry Technology	O.P. Khanna, Dhanpat Rai Publications (1 January 2011)	13: 978-8189928346
2	Foundry Technology	D.B. Goyal & Sinha Standard Publishers Distributors	10: 8186308121, 13: 9788186308127
3	Principle of Metal Castings	R.W. Heine and P.C. Rosenthal, Mc Graw Hill Education; 2nd Edition (22 February 2001)	13: 978-0070993488

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2. https://www.youtube.com/watch?v=qbUDYobvqvI , accessed on 28th May 2024
3. https://www.youtube.com/watch?v=MoTKlQLdtTQ accessed on 28th May 2024
4. https://www.youtube.com/watch?v=9Lsrxgd_cNo accessed on 28th May 2024
5. https://www.youtube.com/watch?v=QEtpDGj9ax4 , accessed on 28th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Various types of Patterns ,foundry sand, moulding machines, Foundry tools
2. Furnaces for melting of metals/alloys.
3. Sieve shaker setup
4. Infra red bulb heating unit

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Shri.K.L. Meshram	HOD, Metallurgical Engineering	Government Polytechnic, Nagpur
2	Miss.V.C. Humney	Lecturer Metallurgical Engineering	Government Polytechnic, Nagpur
3	Shri.S.M.Waikar	Sr. Engineer	Durgapur Steel Plant, Durgapur
4	Prof. Y.Y. Mahajan	Assist. Professor , Metallurgy & Material Science	VNIT , Nagpur
5	Shri D.P.Mukharjee	Sr. Engineer	Ordanace Factory, Ambazari, Nagpur
6	Shri.A.V.Abhyankar	Lecturer Mechanical Engineering	Government Polytechnic, Sakoli
7	Shri S.B.Varadpande	Chief Managing Director	Orange city alloys Pvt.Ltd

(Mr. K.L.Meshram)
HOD & Chairman PBOS, MT

(Dr. G. V. Gotmare)
Member Sectretary PBOS, MT

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/PK/CM/AE/AI/MK
Course Category	:	GE
Course Code	:	TX291H
Course Title	:	General Textile Technology

I Rationale:

This course's goal is to identify the raw materials used in textiles, such as fibers, their sources, and their characteristics. The process of converting fiber into yarn and converting yarn into various fabric development. Since clothing and home furnishings account for a large portion of the family budget, therefore both customers looking to make smart fabric selections need to be knowledgeable about textiles. This course is designed for other program students to gain the knowledge of General textile Technology.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Identify different fibres used in Textile Industry.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** different fiber end use application in textile.

CO2: **Identify** the different spun yarn end use application in woven fabric.

CO3: **Determine** the yarn count of spun yarn

CO4: **Identify** the processes for weaving.

CO5: **Evaluate** the characteristics of woven fabric

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Overview of Textile Industries	1a	Identify textile fibers based on their origin	1.1	Defination of textile Fiber, yarn and fabrics.Classification of textile fibers.Essential and Desirable Properties of Fiber, yarn and fabric	CO1
	1b	Select given textile fibre according to end uses.	1.2	Brief study of some important fibers with their special l characteristics and end uses- Cotton, Jute, linen,Silk, Wool, rayon, Polyster, Nylon, Acrylic, polypropylene and Polyethyelene.	
	1c	Identify the given fibre by given test.	1.3	Identification of textile fibres by different tests- Burning, Microscopic and solubility	

UNIT II: Textile process	2a	Select the different processes required for producing the given yarn.	2.1	Commonly used processes in making of a textile finished product. Various stages involved to convert the raw material into ring spun yarns or threads. Various stages involved to convert the raw material into openend yarns or threads.	CO2
	2b	Compare the given type of yarns on given points.	2.2	Ring spinning yarn manucaturing stages. Classification of textile yarns - spun yarn, carded yarn, combed yarn, woolen yarn, worsted yarn, monofilament yarn and multifilament yarn.	
UNIT III: Yarn quality parmeters	3a	Calculate the count of yarn with the given data.	3.1	Defination of yarn count. Yarn numbering system, Direct yarn numbering system and indirect yarn numbering system. Simple yarn count calculation in indirect and direct yarn numbering system.	CO3
	3b	Determine the characteristics of given yarn.	3.2	Yarn Twist- Direction of yarn twist, characteristics of single yarn and plied yarn. Types and Characteristics of novelty/fancy yarns.	
UNIT IV: Weaving process	4a	Prepare process flow chart for given types of fabric.	4.1	Defination of woven fabric. Preparatory Processes for Weaving - Winding ,warping, pirn winding, sizing and Drawing -in process.	CO4
	4b	Identify the given motions of weaving machine.	4.2	Types of weaving machines. Basic motions of the loom - brief working and defination of shedding motion, picking motion, beatup motion, take up motion, let-off motion, weft stop motion, warp stop motion and brake motion.	

UNIT V: Woven fabric structures	5a	Evaluate the characteristics of given types of fabric.	5.1	Classification of Woven Fabric. Specification Of Woven Fabrics. Importance of dobby weaves and jacquard weaves. Characteristics of shirting fabrics, suiting fabric, towel cloths and fuirnishing cloths	CO5
	5b	Analyse the weave of given fabric sample.	5.2	Fabric Weaves and Properties- Plain weave, rib weave, basket weave, twill weave, satin weave, sateen weave.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Draw the classification chart of textile fibres.	02#	CO1
I	2	Collect different fibre samples- cotton, wool, polyester, viscose, nylon and write their origin, properties and end uses.	02#	CO1
I	3	Identify the given textile fibre by suitable test.	2	CO1
II	4	Prepare passage of materials for yarn formation process of given spinning system.	02#	CO2
II	5	Draw the structure of different types of yarns with its characteristics.	02#	CO2
II	6	Identify different types of yarns.	02#	CO2
III	7	Identify different type of yarn count system .	02#	CO3
III	8	Calculate the count of yarn in given system from the given data.	02#	CO3
III	9	Identify the twist direction in given yarn.	02#	CO3
IV	10	Prepare passage of materials for given fabric formation.	02#	CO4
IV	11	Identify the given type of loom.	02#	CO4
IV	12	Draw daigram of different motion by observing the weaving machine.	2	CO4
V	13	Observe and write the characteristics of different types of fabric.	02#	CO5
V	14	Evaluate the given types of weaves.	2	CO5
V	15	Draw design , draft and peg plan of given weave.	02#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Overview of Textile Industries	4	C	02	04	04	10
			O	0	0	0	0
2	Textile process	8	C	02	08	08	18
			O	0	0	0	0
3	Yarn quality parmeters	4	C	02	04	04	10
			O	0	0	0	0
4	Weaving process	8	C	02	08	08	18
			O	0	0	0	0
5	Woven fabric structures	6	C	02	06	06	14
			O	0	0	0	0
Total		30	C	10	30	30	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q.01 to Q.35	1R2	1U2	1U2	1A2	1A2	2R2	2U2	35/35	
	2U2	2U2	2A2	2A2	2A2	2A2	3R2		
	3U2	3U2	3A2	3A2	4R2	4U2	4U2		
	4U2	4U2	4A2	4A2	4A2	4A2	4A2		
	5R2	5U2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Draw neat sketches and working procedure.	10
2	Identify the functions of important parts.	5
3	Calculation	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	2	-	-	-	3	-	-
CO2	3	-	-	-	-	-	3	-	-
CO3	3	-	-	1	-	-	3	-	-
CO4	3	-	2	-	-	-	3	-	-
CO5	3	-	2	1	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Woven Cloth Construction	A. T. C. Robinson R Marks, Textile Institute Manchester, 1967	13: 9781489958556
2	Weaving : Conversion of Yarns to Fabric	Lord P R and Mohamed M H	13: 9781855734838
3	Winding and Warping	Dr M K Talkudar, Mahajan Publisher	13: 9781859434641
4	Industrial Practices in Weaving Preparation	M K Singh, Woodhead Publishing India	13: 9780857098252
5	Modern Preparation and Weaving Technology	Ormerod A, Butterworth publishers ltd	13: 9780408012126
6	Handbook of Textile Fibres	Cook, J.Gordon, Shildon: Merrow-1984	10: 0904095398
7	Conversion of Yarn to Fabric	P.R.Lord, Wood head Publishing, ltd, England	13: 9781845692902

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7. https://www.textileadvisor.com/2019/10/drawing-in-process-weaving-process.html accessed on 27 may 2024
8. https://www.youtube.com/watch?v=zw8idLj5U2s accessedon 27 may 2024
9. http://www.textileassociationindia.org/ accessed on 27 may 2024
10. https://nptel.ac.in/courses/116/102/116102005/accessed on 27 may 2024

XVI List of Major Equipment/Machineries with Specification:

1. Rapier Loom
2. Warping machine
3. Hand Loom
4. Ring Frame
5. Twist tester
6. Wrap Reel
7. Analytical balance

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.C.P.Kapse	I/C HOD Textile Manufacture	Government Polytechnic, Nagpur
2	Dr. S.G Gaikwad	Selection Grade Lecturer Textile Manufacture	Government Polytechnic, Nagpur
3	Mrs. L.S.Chakraborty	Lecturer, Textile Manufacture	Government Polytechnic, Nagpur
4	Mr Harshal Ramteke	HOD Textile Technology	SASMIRA, Mumbai
5	Dr. Ganesh Kakad	HOD Textile Engineering	JDIT, Yavatmal
6	Mr.Laxminarayan Kaushik	Director	LLP Professional, Nagpur
7	Mr S.S.Lawand	Selection Grade Lecturer, Textile Manufacture	Government Polytechnic, Nagpur
8	Mr.Wasudev Varade	Textile Consultant	LLP Professional, Nagpur

(Dr. C. P. Kapse)
HOD & Chairman PBOS, TX

(Dr. G. V. Gotmare)
Member Sectretary PBOS, TX

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/MT/IT/CM/AI/MK/TX
Course Category	:	GE
Course Code	:	AE291H
Course Title	:	Basics of Automobile

I Rationale:

This course takes students through the working of automobiles from the basics. Students will learn about automobiles piece by piece, even without a any prior knowledge. This course provides an overview of the basic automobiles. It's designed for those seeking a career in the automotive industry or anyone who wants to learn about vehicle repairs.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the knowledge of automobile systems for maintance of vehicle.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Prepare** vehicle layouts with chassis specification.

CO2: **Select** suitable engine for given automobile applications.

CO3: **Interpret** power flow diagrams of transmission systems.

CO4: **Select** suitable braking and steering systems for different applications.

CO5: **Service** the different wheels and tyres.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Automobile	1a	Classify the automobile on the given parameters.	1.1	Automobile: Definition, Classification of Automobiles, Major Components of Automobiles with their Function and Location Vehicle Layout: Definition Significance of Vehicle Layout	CO1
	1b	Identify the type of layout used in given vehicle.	1.2	Different types of Vehicle layouts(FEFWD, FERWD, RERWD, 4WD), Advantages, Disadvantages, Applications and Comparisons of Different types of vehicle layouts.	
	1c	Justify the significance of chassis and frame in given automobile.	1.3	Function of Chassis, Frame and Body: Requirement of Chassis, Frame and Body.	

UNIT II: Engine Systems	2a	Interpret the working of given engine.	2.1	Engine: definition, classification of engines, major parts of multicylinder engine with their location and function, engine terminology and nomenclature, working of four stroke SI engine, working of four stroke CI engine	CO2
	2b	Identify the components of given system in engine.	2.2	Lubrication and Cooling system: Purpose of lubrication, types of lubrication systems, working of pressurized lubrication system. Purpose of cooling system, construction and working of engine air cooling, construction and working with major components of engine liquid cool system.	
	2c	Justify the significance of given battery.	2.3	Battery: Function and Requirements of Battery, Types of Battery, Principle of Lead Acid Battery. Ignition System: Function and Requirement of Ignition System, working and components with their function of distributor-less ignition System	
	2d	Determine the requirements of given system.	2.4	Charging System: Function and Requirement of Charging System, Components of Charging System. Starting System: Function and Requirement of Starting System, Components of Starting System. Charging System: Function and Requirement of Charging System, Components of Charging System	

UNIT III: Automobile Transmissions Systems	3a	Justify the necessity of given clutch.	3.1	Function and Necessity of Clutch: Requirement of Clutch, Classification of Clutch, Working Principle of Clutch, Construction and Working of Single Plate (Coil Spring and Diaphragm).	CO3
	3b	Identify components of the given gear box.	3.2	Function and Necessity of Gear Box Manual Transmission: Classification of Gear Box, Construction and working of Constant Mesh and Synchro Mesh Gear Box. Automatic Transmission: Advantages & disadvantages, Components and their Function	
	3c	Classify the given givenr shaft of automobile.	3.3	Propeller Shaft Assembly: Function, Necessity and Types of Propeller Shaft, Function and necessity of Universal and Slip Joint	
	3d	Determine the Working principle of given differential in automobile.	3.4	Final Drive: Function and Necessity of Final Drive, Differential, Working principle Construction and Working of Differential	
	3e	Specify the types of axles in given automobile.	3.5	Axles: Significance of Live and Dead Axle, Function and Requirement of Front Axle, Types of (Front) Stub axle.	
Control System	4a	Differentiate between given brakes.	4.1	Automobile Braking System: Function and Requirement of Braking System: Principle of Braking, Basic Terms related to Braking (Stopping Distance, Braking Efficiency, Fading of Brakes) Types of Braking System: Layout, Construction, Working of Drum, Disc, Hydraulic and Air Brakes.	

UNIT IV: Automobile	4b	Justify the significance of steering system in given automobile.	4.2	Automobile Steering System: Function and Requirements of Steering System: Basic Terms related to Steering(Steering Ratio, Turning Radius, Understeering and Oversteering), Basic Components of Steering Linkages. Necessity and Principle of Power Steering, working of hydraulic and electronic power steering. steering gear box: function and types	CO4
UNIT V: Automobile suspension, wheels and tyres	5a	Justify the significance of suspension system in given automobile.	5.1	Automobile Suspension System: Function and Requirement of Suspension System, Types and Constructional Features of Leaf Springs	CO5
	5b	Identify Components of given suspension system.	5.2	Function and Requirement of Independent Suspension System: Advantages of Front Wheel Independent Suspension, Shock Absorbers and Air Suspension: Layout, Construction and Working of Air Suspension.	
	5c	Justify the significance of wheel balancing and alignment.	5.3	Wheels, Rims and Tyres: Function, Necessity and Requirement of Wheel, Rim and Tyres: Factors affecting to Tyre Life, Tyre Wear and Rotation, Tyre Designation. Wheel Alignment and Balancing: Purpose of Wheel Alignment, Purpose of Wheel Balancing,	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare a layout of vehicle available in your Laboratory.	2#	CO1
II	2	Dismantle/Assemble and identify the components of single cylinder engine.	2	CO2
II	3	Dismantle/Assemble and identify the components of Multicylinder cylinder engine.	2#	CO2
II	4	Dismantle/Assemble and identify the components of engine lubrication system.	2	CO2
II	5	Dismantle/Assemble and identify the components of engine cooling system.	2	CO2
II	6	Dismantle/Assemble and identify the components of engine charging system.	2	CO2
II	7	Dismantle/Assemble and identify the components of engine Ignition system.	2#	CO2
II	8	Perform test on given battery and comment condition of it.	2#	CO2
III	9	Dismantle/Assemble and identify the components of manual gearbox.	2#	CO3
III	10	Dismantle/Assemble and identify the components of automatic transmission.	2	CO3
III	11	Dismantle/Assemble and identify the components of clutch.	2#	CO3
III	12	Dismantle/Assemble and identify the components of differential.	2#	CO3
III	13	Dismantle/Assemble and identify the components of propeller shaft.	2	CO3
III	14	Dismantle/Assemble and identify the components of axle and drive.	2	CO3
IV	15	Dismantle/Assemble and identify the components of steering system.	2#	CO4
IV	16	Dismantle/Assemble and identify the components of braking system.	2#	CO4
V	17	Dismantle/Assemble and identify the components of suspension system.	2	CO5
V	18	Perform puncture repair, replace spare tyre and identify the tyre wear.	2#	CO5
V	19	Perform wheel balancing and wheel alignment of given vehicle.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Automobile	4	C	02	04	02	08
			O	00	00	00	00
2	Engine Systems	8	C	04	06	08	18
			O	00	00	00	00
3	Automobile Transmissions Systems	6	C	04	06	06	16
			O	00	00	00	00
4	Automobile Control System	6	C	02	06	06	14
			O	00	00	00	00
5	Automobile suspension, wheels and tyres	6	C	02	06	06	14
			O	00	00	00	00
Total		30	C	14	28	28	70
			O	00	00	00	00

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyse / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
1	1R2	1U2	1U2	1A2	2R2	2R2	2U2	35/35
2	2U2	2U2	2A2	2A2	2A2	2A2	3R2	
3	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
4	4R2	4U2	4U2	4U2	4A2	4A2	4A2	
5	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyse / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	System diagram, selection of equipment	5
2	Performance	10
3	Identification of compenets	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-
CO3	3	3	-	3	-	-	-	3	-
CO4	3	3	-	3	2	-	2	-	-
CO5	3	3	-	3	2	-	2	-	2
CO6	3	3	-	3	2	-	2	3	-

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S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Automobile Engineering Vol.I	Dr. Kripal Singh, Standard Publishers Distributors, 13th Edition, 2023	13: 97881801419669
2	Automotive Mechanics	Crouse. W.H., Anglin, McGraw Hill Education (India) Private Limited,10th Edition, 2021	10: 81-219-2440-5
3	Basic Electrical Engineering	V.N.Mittle, Arvind Mittal, The McGraw Hill Education Pvt. Ltd, Reprint, 2021	10: 0070634351
4	Automotive Mechanics	N. K. Giri, Khanna Publishers, Delhi,Eighth Edition, 2020	13: 9788174092168
5	Motor Automotive Technology	Anthony E. Schwalle, Delmar Publisher Inc., 2nd Edition, 2020	13: 978-0827351004
6	Automotive Mechanics	S. Srinivisan,Tata McGraw – Hill, 2nd Edition, 2023	13: 9780070494916
7	Basic Automobile Engineering	Nakra CP , DhanpatRai Publishing Company (P) Limited, 2018	13: 9788187433224

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1. https://www.youtube.com/watch?v=QPaUJfA1KsY, assessed on 30th May 2024
2. http://auto.howstuffworks.com/cvt.htm,assessed on 30th May 2024
3. http://www.carbibles.com/transmission_bible_pg3.html, assessed on 30th May 2024
4. https://www.youtube.com/watch?v=hs7bABMtOMI&list=PLyqSpQzTE6M9G2SNxKfsVEjcM9MlJau4F assessed on 30th May 2024
5. https://www.youtube.com/watch?v=UJfjR1O52F8&list=PLaukeqsMWUOCoI7_tTgB494kRPaSaREVY assessed on 30th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Air compressor-1 HP 3 phase, Max Pressure: 4, 95 kg/cm², 70 ltr.
2. Bottle/Floor/Scissor Jacks- 3 ton Capacity.
3. Socket/ Impact wrenches-¼", 3/8", ½" and 3/4"
4. Torque wrenches- 3/8", ½"and 3 NM, Ratcheting type/Click-type.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. G.K. Awari	HOD, Automobile Engineering	Government Polytechnic, Nagpur
2	Dr. K.S. Dixit	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur
3	Prof. D. K. Bawane	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur
4	Prof. Syed J. M.	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur
5	Dr.Suhas Kongre	Sr. Lecturer in Mechanical	ASTS Polytechnic, Wardha
6	Mr. Pramod Nichat	Rtd. Asst. General Manager	Ashok Leyland Ltd; Chennai
7	Dr Manoj Basashankar	HOD, Mechanical Engineering	Suryodya Polytechnic & Engineering College, Nagpur

(Dr. G. K. Awari)
HOD & Chairman PBOS, AE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, AE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/TX/AE/CM/MK/AI
Course Category	:	GE
Course Code	:	PK291H
Course Title	:	Basics of Packaging Technology

I Rationale:

This course introduces the basics of packaging, covering its different levels and functions in business. Students will learn about various packaging materials and how demographics affect packaging choices. The course also includes an overview of testing and quality standards, helping students understand how to ensure packaging meets industry requirements. This foundational knowledge is useful for anyone interested in the broader aspects of packaging business.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the knowledge of basics of packaging in various packaging applications

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the levels of packaging.

CO2: **Identify** the technical and commercial functions of packaging.

CO3: **Identify** the various sectors of a packaging business**.**

CO4: **Identify** the packaging material and appreciate the demographic influence on packaging business.

CO5: **Identify** the testing and quality standards and perform the test.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Packaging Technology	1a	Justify the importance of packaging in supply chain.	1.1	Introduction; Definition and Importance of Packaging in supply chain, Evolution of Packaging.	CO1
	1b	Identify given segmentation of packaging industry	1.2	Indian packaging industry present scenerio; Key Players and Market Segmentation.	
	1c	Identify the given levels of packaging.	1.3	Levels of packaging: Primary, Secondary and Tertiary.	
	1d	Select the correct advantages and disadvantages of packaging.	1.4	Advantages of packaging to - Customer, retailer, distributor, handler, transporters, manufacturers, society, and nation. Disadvantages of packaging - Cost, Environmental Impacts; resource utilization, energy, toxicity, litter, solid waste, deception.	

UNIT II: Functional Considerations of Packaging	2a	Identify the technical functions of packaging from given options.	2.1	Functional Considerations of Packaging: Technical Functions - Containment, protection (against mechanical damages), preservation (against Physiochemical damages).	CO2
	2b	Identify the commercial functions of packaging from given options.	2.2	Commercial functions - Sanitation, unitization, communication (Human & Machine), dispersing & dispensing, pilferage deterrence, tampering evidence etc.	
UNIT III: The Packaging Business	3a	Identify the given sector of a packaging business.	3.1	The Packaging Business: a. Packaging material suppliers: Basic raw materials, materials for packaging. b. Converting of raw materials, converting of packaging materials. c. Ancillary Packaging materials. d. Packaging user industries; Food, Pharma and other.	CO3
ging Materials	4a	Identify packaging materials from given properties.	4.1	Overview of Packaging Materials; Wood, paper, plastics, glass, metals. Properties and Characteristics of Packaging Materials Selection Criteria for Packaging Materials. Emerging Trends in Sustainable Packaging Materials.	

UNIT IV: Packa	4b	Select the correct point for demographic influence on packaging industry.	4.2	Demographic influence on packaging business; growing population, shifts in definition of household units, geographic redistribution, increase in number of working women, increase in number of single living, increase in number of two earner household.	CO4
UNIT V: Packaging Processes , testing and quality control.	5a	Identify the given packaging process.	5.1	Packaging Processes: Packaging Design Principles, Printing and Labeling Techniques, Forming and Filling Processes, and Sealing and Closing Techniques.	CO5
	5b	Identify the given testing standard.	5.2	Packaging Testing and Quality Control; Importance of Packaging Testing, Testing Standards and Methods, Testing and Quality control , Packaging Tests; durability, leakage, compression.	
	5c	Identify the given quality standard.	5.3	Quality standards in packaging business; quality management system, food safety management systems, Goods Manufacturing Practices. Food and Drug Administration (FDA)	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Conduct a case study on Indian Packaging Industry: A current scenerio and write a report on it.	2#	CO1
I	2	Carry out group discussion to identify the levels of packaging; form groups, collect the samples, observe, study, search relevant information and write a report.	2#	CO1
II	3	Carry out group discussion to identify the Technical Functions of a given Packaging System. Form groups, collect the samples, observe, search relevant information and write a report.	2#	CO2
II	4	Conduct a case study on demographic influence on growth of packaging business. Take any one topic from; shifts in definition of household units, geographic redistribution, increase in number of working women, increase in number of single living, increase in number of two earner household. And write a report.	2#	CO2
II	5	Carry out a group discussion to identify the commercial functions of a given Packaging System; form groups, select a packaging system, observe and study it, collect information, brain storm and write a report.	2#	CO2
III	6	Carry out a case study on Exploring the Dynamics of the Indian Packaging Business and write a report.	2	CO3
IV	7	Perform CFB box packaging manually - erection, loading and sealing. Search and collect the information on unitization, styles of corrugated boxes and box sealing methods and materials.	2#	CO4
IV	8	Perform box compression test on a given sample.	2#	CO4
IV	9	Perform liquid filling by liquid volumetric filling machine (model/portable). Note the findings and observations.	2#	CO4
IV	10	Perform box filling, stapling, sealing, and shrink wrapping operations.	2#	CO4

IV	11	Perform box filling, sealing, automatic strapping and stretch wrapping operations.	2#	CO4
V	12	Carry out a case study on Functions of Food and Drug Administration.	2#	CO5
V	13	Identify the plastic by manual observation and handling the product. Write a report.	2	CO5
V	14	Draw a format related to testing of packaging material by reading the existing any one Indian Standard.	2#	CO5
V	15	Draw a format related to the quality standard by reading the existing any one standard from: quality management system/ food safety management systems/ Goods Manufacturing Practices/ Food and Drug Administration (FDA).	2	CO5

Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hour	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Packaging Technology	6	C	02	06	04	12
			O	0	0	0	0
2	Functional Considerations of Packaging	6	C	02	06	04	12
			O	0	0	0	0
3	The Packaging Business	6	C	02	06	04	12
			O	0	0	0	0
4	Packaging Materials	6	C	06	08	04	18
			O	0	0	0	0
5	Packaging Processes, testing and quality control	6	C	04	06	06	16
			O	0	0	0	0
Total		30	C	16	32	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
1	1R2	2R2	3R2	4R2	5R2	4R2	5R2	35/35
2	4R2	1U2	2U2	3U2	4U2	5U2	1U2	
3	2U2	3U2	4U2	5U2	5U2	4U2	3U2	
4	2U2	1U2	4U2	1A2	2A2	3A2	4A2	
5	5A2	5A2	4A2	3A2	2A2	1A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of equipment/Materials	5
2	Performance	10
3	Calculation, Result, Drawing Graphs, diagram (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	2	-	2	-	-
CO5	3	-	-	3	2	-	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Introduction To Packaging	Frank A. Paine, Heather Y. Paine, Springer, Second E, 1983	13: 978-1-4613-6214-2
2	Packaging In The Environment	Geoffrey M. Levy, Springer, Chapman and Hall, 1993	13: 9781461358909
3	The Packaging User's Handbook	F.A. Paine,Chapman and Hall, New Edition,1995	13: 978-0-7514-0151-6
4	Handbook of Packaging	F.A. Paine	-
5	Fundamentals of Packaging Technology	Walter Soroka, Institute of Packaging Professionals, Virginia	-

XV e-References:

1. https://www.youtube.com/watch?v=qAGCI0-pQ3E assessed on 3rd March 2024
2. https://www.youtube.com/watch?v=KMvRqygi04g assessed on 11th March 2024
3. https://www.youtube.com/watch?v=7yAjgT5NAkE assessed on 12th March 2024
4. https://www.youtube.com/watch?v=wugmX85ipRU assessed on 15th March 2024
5. https://www.youtube.com/watch?v=epAh6hHOq3c assessed on 15th March 2024
6. https://www.youtube.com/watch?v=I1E0RdHw9gU assessed on 15th March 2024
7. https://www.youtube.com/watch?v=CdTx-26q3M8 assessed on 15th March 2024
8. https://www.youtube.com/watch?v=LKW8G_AIYbw assessed on 16th March 2024
9. https://www.youtube.com/watch?v=-0w61b6wppg assessed on 18th March 2024
10. https://www.youtube.com/watch?v=jODl07akVHM assessed on 18th March 2024

XVI List of Major Equipment/Machineries with Specification:

1. Desktop computers with internet facility
2. Box Compression Testing Machine
3. Liquid Voumetric Filling Machine
4. Automatic Box Strapping Machine
5. Box Stapling Machine
6. Shrink Wrapping Machine
7. Pallet Stretch Wrapping Machine

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. Syed Imran Ahmed K.	I/c. Head of Packaging Technology.	Government Polytechnic, Nagpur.
2	Mr. Subhash N. Madhugiri	Rtd. Head of Department, Packaging Technology.	Government Polytechnic, Nagpur.
3	Mr. Rajesh S. Raool	Rtd. Lecturer in Packaging Technology	Government Polytechnic, Nagpur.
4	Dr. Milind S. Deshpande	Lecturer in Mechanical Engineering.	Government Polytechnic, Arvi.
5	Mr. Prasd B. Iyer	Director	SIES School of Packaging, Mumbai.
6	Mr. Uday D. Raut	Managing Director	B.R. Plastic Industries, MIDC, Nasik.
7	Mr. Ali M. Zeeshan M.S.M	Assistant Prof. in Mechanical Engineering	Anjuman College of Engineering Nagpur.

(Mr. Syed Imran Ahmed K.)
HOD & Chairman PBOS, PK

(Dr. G. V. Gotmare)
Member Secretary PBOS, PK

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/MT/TX/AE/PK/MK
Course Category	:	GE
Course Code	:	CM291H
Course Title	:	Open Source Technologies

I Rationale:

Studying open-source tools like LaTeX, Canva, and Synfig provides a practical and cost-effective approach to develop essential skills for various professional and creative endeavors. LaTeX is used for document formatting, particularly in academic and scientific writing. Canva equips individuals with the ability to create visually appealing content for presentations, marketing materials, and social media, fostering creativity and design thinking. Synfig empowers users to produce animated multimedia content, supporting the growing demand for dynamic and engaging visual communication.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge to dvelop precise document with formatting, graphic design for visual communication, and animation creation for multimedia. content.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Design** an article using basic command of Latex.

CO2: **Use** Latex tags for Page formatting, tables, images, equations.

CO3: **Design** presentation using Latex Beamer.

CO4: **Create** Poster, Business Card,logo, invitation cards using Canva.

CO5: **Use** Synfig to design annimations.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Latex	1a	Chooose the correct document class to create a book in Latex a. Chapter b. Article c. Book d. Section	1.1	Installation of MikeTeX, Online Overleaf access, TEX and its offspring.	CO1
	1b	Select the syntax to divide the document in sections in latex. a. section{Name of section} b. document class{Section name} c. article{section} d. createSection {Name of section}	1.2	Creating a Title, Sections, Command names, and date arguments, Labelling Table of Contents.	
	1c	Identify the correct command to change the font colour. a. \textcolor b.\setcolor c. \color d. \fontcolor	1.3	Font Effects, Coloured Text, Font Sizes, Comments & Spacing Special Characters, Line breaking.	

	1d	Select the correct command to load packages in latex. a. \usepackage{} b. \setpackage{} c. \package{} d. \createpackage{}	1.4	Document Layout and Organization- Page Layout – Titles, Abstract Chapters, Sections, References, citation, Generating index, Loading packages.	
UNIT II: Page formatting in latex.	2a	Choose the correct option to create a numbered list in Latex. a. itemize b. enumerate c. ol d. ul	2.1	List-making environments, Table of contents, Adding tables, Figure handling , Adding Equations/mathematical expressions.	CO2
	2b	Select the command to set double column in Latex. a. \documentclass[twocolumn]{article} b. \[twocolumn]{article} c. \document[twocolumn]{article} d. \class[twocolumn]{article}	2.2	Parts of the document: Abstract, Chapters, Appendix, Paragraph formatting, Single and double column pages	
	2c	Select the command used to set the footer of a LaTeX document using the \texttt{fancyhdr} package. a)	2.3	Parts of the document: Customized head and foot lines, Page numbering, Fancy header	
	2d	Identify the LaTeX environment used to manually insert a bibliography when a bibliography management package not being used? a) \texttt{bibliography} b) \texttt{bibblock} c) \texttt{thebibliography} d) \texttt{biblio}	2.4	Inserting References: Inserting the Bibliography Styles.	

UNIT III: Latex Beamer	3a	Select beamer command to create a title page in a Beamer presentation. a) \texttt{\textbackslash maketitle} b) \texttt{\textbackslash titlepage} c) \texttt{\textbackslash beamer_title} d) \texttt{\textbackslash titlingpage}	3.1	Introduction to Beamer: The title page, Creating a table of contents, Adding effects ta a presentation.	CO3
	3b	Identify beamer command to change the font for the entire document to a specific size and style. a) \texttt{\textbackslash setfont{}} b) \texttt{\textbackslash usefont{}} c)	3.2	Highlighting important sentences/words. Fonts: Font sizes, Font types , Using Beamer's Fonts, Setting Beamer's Fonts. Columns	
	3c	Select package to be included to handle images in LaTeX. a) \texttt{\textbackslash usepackage{graphicx}} b) \texttt{\textbackslash usepackage{graphics}} c) \texttt{\textbackslash usepackage{imagex}} d) \texttt{\textbackslash usepackage{imaging}}	3.3	Adding tables, mathematical expressions, images to presentations.	

	3d	Choose the correct option to set the color theme to "dolphin" to match the "Berkeley" theme in Beamer presentation. a) \texttt{\textbackslashuse theme{Berkeley}\ textbackslash setcol ortheme{dolphin}} b) \texttt{\textback slash settheme {Berkeley} \textback slash usecolor theme{dolphin}} c) \texttt{\textback slash usetheme{Ber keley}\textbackslashus ecolortheme{dolphin} } d) \texttt{\textbacks lash usetheme {Berk eley}\textbackslashc olortheme{dolphin}}	3.4	Themes and colorthemes: Berkeley theme, Copenhagen theme, Using a colortheme.	
	4a	Identify the primary purpose of Canva templates. a) To download images b) To provide pre-designed layouts for various types of design projects c) To create animations d) To write code	4.1	Logging / Setup Canva Account, Layouts & Templates, the pre-designed layouts, Downloading the work.	

UNIT IV: Basics of Canva	4b	Select the purpose of shapes in Canva designs. a) To create text boxes b) To add visual elements and structure to a design c) To replace photos d) To write code	4.2	Working with text, Photo backgrounds & Shapes, Illustrations, icons and lines, Adding pages to a design.	CO4
	4c	Identify the correct option to add text to a Canva design. a) By clicking on the "Photos" section b) By selecting the "Text" tab and choosing a text box c) By uploading a text file d) By using the "Elements" section	4.3	Adding Images, photo filters, Text features, adding Charts, Album cover.	
	4d	Select is the purpose of a YouTube thumbnail. a) To summarize the video content in a single image b) To attract viewers and increase click-through rates c) To provide additional information about the video d) To create a playlist of videos	4.4	Youtube thumbnail, Twitter header, Facebook post, Ebook cover.	
	4e	Select the feature to add transitions between slides in Canva. a) Animation effects b) Slide sorter c) Background music d) Presenter view	4.5	Documents, Data and charts, Presentation slides.	

UNIT V: Itroduction to Synfig	5a	Select is the correct primary purpose of Synfig. a) Creating 3D animations b) Editing images c) Designing logos d) Producing 2D animations	5.1	Overview of Synfig, Installation of Synfig, Explore the user interface, keyframes.	CO5
	5b	Select the correct panel in Synfig to import and manage images. a) Toolbox b) Parameters c) Canvas d) Layer panel	5.2	Introduction to Layers, Using Pictures In Synfig, including the canvas, toolbox, and layer panel.	
	5c	Identify type of animation in Synfig to create movement in a shape that resembles a celestial object. a) Star animation b) Plant animation c) Basic bone animation d) Logo animation	5.3	Creating Animation Using Synfig: Logo animation, Cutout animation, Underwater annimation, Bouncing ball annimation, Creating star annimation, Plant annimation, Basic bone annimation.	
	5d	Choose the correct text animation option in Synfig to make the text appear as if it is being typed out letter by letter. a) Typewriter b) Write c) Scroll d) Fade In	5.4	Adding text to annimation, text annimation options.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Install Latex and Create a simple document using LaTeX.	2#	CO1
I	2	Design a simple LaTeX document with a title, author, date and add differnt font styles, sizes, and colors. Divide the document into sections and subsections. Add a table of contents and ensure it is updated correctly.	2	CO1
II	3	Develop ordered and unordered lists, nest the lists and customize the list symbols using Latex. Create a Latex document and insert images into the document.	2#	CO2
II	4	Create a Latex document and add a table with rows and columns,add captions. Design a Latex document with Mathematical expression, Equations and Formulas using inline and display math modes. Explore various mathematical symbols and notations. Experiment with complex mathematical equations and formulas. Utilize environments like `align` for multiline equations.	2#	CO2
II	5	Design a Latex document. Add citations to your document using the BibTeX or BibLaTeX system.Create a bibliography section and reference external sources.	2	CO2
II	6	Develop a Latex doument. Add lists of figures and tables. Ensure proper numbering and referencing.Use labels and cross-references for sections, equations, and figures. Verify that references are updated correctly.	2#	CO2
III	7	Create a simple Beamer presentation. Add multiple slides with titles and subtitles. Experiment with different slide themes.	2#	CO3
III	8	Create a simple Beamer presentation with a title, author, and date. Use the `frame` environment to add a slide. Add multiple slides with titles and subtitles. Experiment with different slide themes.	2	CO3
III	9	Insert Images and Tables in Beamer slides.Adjust the size and positioning of images. Create simple tables with rows and columns.Add headers and customize table styles.	2#	CO3

IV	10	Create a Canva account and explore the basic features of the platform. Familiarize with the dashboard and layout options. Design a social media post for a fictional event or promotion. Use Canva's templates, elements, and text tools.	2#	CO4
IV	11	Design an eye-catching Posters using Canva for a school event or project. Experiment with different fonts, colors, and layouts.	2#	CO4
IV	12	Design a canva poster, insert Photo, Enhance a photo using Canva's photo editing tools. Add filters, adjustments, and overlays.	2#	CO4
V	13	Install Synfig on computer. Explore the user interface, including the canvas, toolbox, and layer panel. Draw a simple shape (e.g., a circle or square) and animate its movement across the canvas.Experiment with keyframes to create basic animations.	2#	CO5
V	14	Create a simple Synfig application, Import external images (e.g., PNG, JPEG) into Synfig. Explore techniques for scaling, rotating, and animating imported images.	2#	CO5
V	15	Design Text Animation using Synfig: - Add text to the animation and explore text animation options. - Animate text appearing, moving, or changing color.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Not Applicable.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Latex	4	C	04	06	04	14
			O	00	00	00	0
2	Page formatting in latex.	8	C	02	06	06	14
			O	00	00	00	0
3	Latex Beamer	6	C	04	04	06	14
			O	00	00	00	0
4	Basics of Canva	6	C	02	06	06	14
			O	00	00	00	0
5	Itroduction to Synfig	6	C	02	06	06	14
			O	00	00	00	0
Total		30	C	14	28	28	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q 1 to Q 35	1R2	1R2	1U2	1U2	1U2	1A2	1A2	35/35	
	2R2	2U2	2U2	2U2	2A2	2A2	2A2		
	3R2	3R2	3U2	3U2	3A2	3A2	3A2		
	4R2	4U2	4U2	4U2	4A2	4A2	4A2		
	5R2	5U2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Proper Coding	10
2	Debugging	5
3	Output	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	3	3	3	3	-	-
CO2	-	-	-	3	3	3	3	-	-
CO3	-	-	-	3	3	3	3	-	-
CO4	-	-	-	3	3	3	3	-	-
CO5	-	-	-	3	3	3	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	LaTeX: A document preparation system, User's guide and reference manual	Leslie Lamport,Addison Wesley, 2nd edition, 1994	978-0201529838
2	The LaTeX Companion, 3rd edition (TTCT series)	Frank Mittelbach with Ulrike Fischer,Addison-Wesley Professional, 3rd edition, 2023	978-0-13-816648-9
3	LaTeX Beginner's Guide	Stefan Kottwitz, Packt Publishing, 1st edition, 2011	978-1847199867
4	Canva Tips and Tricks Beyond The Limits Paperback – Import	Koushik K , 11 December 2020, 1st Edition	978-1-393-25537-6
5	Synfig Studio (English version): 2D Animation	AMC College, First Edition , Advanced Micro Systems Sdn Bhd	978-967-2403-36-4

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2. https://www.maths.tcd.ie/~dwilkins/LaTeXPrimer, accessed on 20th May , 2024
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XVI List of Major Equipment/Machineries with Specification:

1. Computer I3 or higher version
2. Desktop Computer: I3 or higher version.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. M. V. Sarode	HoD, Computer engineering	Government Polytechnic, Nagpur
2	Dr. M. V. Sarode	HoD, Computer Engineering	Government Polytechnic, Nagpur
3	Dr U B Aher	Lecturer, Computer engineering.	Government Polytechnic, Nagpur
4	Mr. P. S. Thakre	Lecturer, Computer engineering.	Government Polytechnic, Nagpur
5	Dr K L Bawankule	Lecturer, Computer engineering.	Government Polytechnic, Nagpur
6	Dr. Rakesh Kadu	Assistant Professor, IT, RBU	Ramdeobaba College of Engineering Nagpur
7	Mr. Dipak Dhote	Operation Manager	IT-Network Infosystem Pvt Ltd.
8	Mrs. V. A. Raje	System analyst	MSBTE, RO, Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/AE/TX/CM/IT/AI/PK/MT
Course Category	:	GE
Course Code	:	MK291H
Course Title	:	Basic Mechatronics

I Rationale:

This curriculum includes basic concepts, principle of working and applications of various electronics and mechanical components that are being used for developing various circuits in industry. This curriculum is essential to provide students with a brief foundational knowledge in this interdisciplinary field. Mechatronics combines mechanical engineering, electronics, computer science, and control engineering to create innovative and efficient systems. This course enables diploma engineer to use various basic electronic and mechanical components for specific applications.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Integrate electronics and mechanical components to create functional mechatronics systems, such as robotics and automated machinery.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** specific basic electronics component for given electronics applications.

CO2: **Design** a logic circuit using various digital electronics components.

CO3: **Select** various transducers and sensors for different mechatronics based applications.

CO4: **Interface** microcontroller with peripheral devices.

CO5: **Use** actuators for various mechatronics based applications.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Basic Electronics	1a	Select the relevant diode for given application	1.1	PN junction diode: Symbol, Construction, working principle, V-I characteristics and applications, Special purpose diodes - Zener diode, LED, Photodiode (Symbol, working principle and applications)	CO1
	1b	Select the transistor for given application	1.2	NPN and PNP transistor: Symbol, Construction, Operating principle, Input-output characteristics, Operating regions of transistor, Applications of transistor as a switch, as an amplifier-circuit diagram and working principle	
	1c	Identify given blocks of regulated power supply with their functions.	1.3	DC regulated power supply: Need and block diagram. Regulators: Need for voltage regulators in power supplies, working of voltage regulator using Zener Diode	

UNIT II: Digital Electronics	2a	Convert the given number into specified number system	2.1	Introduction to digital systems: Number systems - binary, decimal, octal and hexadecimal conversion of one number system to other.binary addition and subtraction	CO2
	2b	Identify symbols and truth tables of given logic gates.	2.2	Logic Gates, Classification of gates: NOT, AND, OR, symbols, truth table, logic equations, universal logic gates - NOR, NAND, symbols, truth table, basic logic gates using universal gates, Exclusive OR/NOR gates	
	2c	Identify given combinational logic circuit	2.3	Combinational logic circuits, Design of half and full adder using k-map, Multiplexers and Demultiplexers: block diagram, truth table, logic expression and logic diagram of 2:1, 4:1, 8:1 MUX, 1:2, 1:4, 1:8 DEMUX	
	2d	Identify sequential logic circuit used for given application	2.4	Flip Flops - Symbols and truth table of D flip flop, T- flip flop, S R Flip Flop, J-K Flip Flop, Shift Register: Logic diagram, Truth Table of 4-bit shift registers (SISO, SIPO, PISO, PIPO), Counters - Asynchronous and synchronous counter	
ensors	3a	Identify type of given transducer	3.1	Definition of transducer, Classification – Active/Passive, Primary/Secondary, Electrical/Mechanical, Analog/Digital and their examples	

UNIT III: Transducers & S	3b	Select the relevant transducer for the given application	3.2	Selection Criteria for transducers Principle of working and application of i. Displacement transducers - LVDT, RVDT ii. Strain Gauge, Load cell, Cantilever arm	CO3
	3c	Select the relevant sensor for the given application	3.3	Definition of sensor, Types of sensor,Principle of working and applications of – i. Pressure Sensors - Bourdon Tube ii. Temperature Sensors - RTD, Thermistors. Iii. Photo sensors – Photodiode, LDR, LED iv. Proximity Sensors – Capacitive, Inductive	
UNIT IV: Microcontroller	4a	Identify type of given microcontroller	4.1	Introduction to 8051 Microcontroller : Architecture, Pin configuration, input-output ports, interrupts, types of microcontroller, Applications	CO4
	4b	Choose interfacing circuit to interface microcontroller with given peripherals	4.2	Interfacing of 8051 microcontroller with LED, switch, seven segment display	
tors	5a	Identify the given actuator with the help of features, specifications, sketch, working principle and applications.	5.1	Actuating Systems – Hydraulic, Pneumatic system, Features, specifications, sketch, working principle and applications of : Pneumatic Actuators - Direction Control Valves – Spool, Poppet, pilot operated, Directional Valves, Valve actuation symbols, Pressure Control Valves – Pressure regulating, Pressure Limiting, Cylinders – Single acting, Double acting	

UNIT V: Actua	5b	Select the relevant actuator for given application	5.2	Mechanical Actuators - Types of motion (Translational, Rotational), Kinematic Chains (Four bar chain, Slider-crank mechanism), Cams (Eccentric, Heart shaped, Pear Shaped), Cam followers, Gears (Gear trains, rack-and-pinion gears), Ratchet & Pawl, Bearings (Plain journal, Ball and roller bearings), Electrical Actuators – Stepper motor – Types (Variable reluctance, Permanent magnet, Hybrid Stepper motor), Stepper motor specifications, Stepper motor Control	CO5

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify and Test PN junction diode using digital multimeter Also Plot VI characteristics in forward biased mode.	2#	CO1
I	2	Build a circuit for transistor as an amplifier on a breadboard and observe it's input and output waveforms.	2#	CO1
I	3	Test performance of zener diode as a voltage regulator.	2#	CO1
II	4	Realize basic gates using NOR/NAND gate and verify truth table.	2#	CO2
II	5	Design the logic circuit for half adder and full adder using logic gates and verify its truth table	2#	CO3
II	6	Identify different pins of 8:1 multiplexer IC , apply input and measure the output. Relate practical output with it's truth table.	2#	CO4
III	7	Measure linear displacement using LVDT.	2#	CO4
III	8	Measure temperature using thermistor.	2#	CO4
III	9	Measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.	2#	CO3
IV	10	Develop a program for interfacing LED with 8051 microcontroller	2#	CO4
IV	11	Develop a program for interfacing switch with 8051 microcontroller	2#	CO4
IV	12	Develop a program for interfacing seven segment display with 8051 microcontroller	2	CO4
V	13	Select actuator for given application with justification	2#	CO5
V	14	Develop small circuits using Cam followers, Gears, Ratchet & Pawl, Bearings	2	CO5
V	15	Build Electro-pneumatic circuits for given application	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Basic Electronics	6	C	4	4	6	14
			O	0	0	0	0
2	Digital Electronics	6	C	2	4	8	14
			O	0	0	0	0
3	Transducers & Sensors	6	C	2	4	8	14
			O	0	0	0	0
4	Microcontroller	6	C	2	4	8	14
			O	0	0	0	0
5	Actuators	6	C	4	4	6	14
			O	0	0	0	0
Total		30	C	14	20	36	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	1U2	1U2	1A2	1A2	1A2	35/35	
2	2R2	2U2	2U2	2A2	2A2	2A2	2A2		
3	3R2	3U2	3U2	3A2	3A2	3A2	3A2		
4	4R2	4U2	4U2	4A2	4A2	4A2	4A2		
5	5R2	5R2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-		-	-
CO2	3	-	1	1	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	1	1	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Principles Of Electronic Devices & Circuits	A.K.Theraja, B.L.Theraja, R.S.Sedha S. Chand and Co. Ltd., Reprint, 2005	10: 8121921996 13: 9788121921992
2	Principles of Electronics	Mehta, V.K. Mehta, Rohit, S.Chand, New Delhi, 2014	13: 9788121924504
3	Modern Digital Electronics	Jain R.P, McGraw-Hill Publishing, New Delhi, 2011	13: 9780070669116
4	A course in Electrical and Electronics Measurement and Instrumentation	A.K. Sawhney, Dhanpat Rai Publication, 10th Edition, 1994	13: 9788177001006
5	Mechatronics	Bolton W. Addison Wesley Longman Ltd.,U.S.A 1999	13: 9780582357051
6	Mechatronics	H.M.T. McGraw-Hill Education, New Delhi.2000	10: 0074636435

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2. https://www.electronics-tutorials.ws/accessed on 22nd May 2024
3. https://www.electronics-tutorial.net/analog-integrated-circuits/ accessed on 22nd May 2024
4. https://www.youtube.com/playlist?list=PLLy_2iUCG87BNHXRb6L2pWEpMcLoFaY_U, accessed on 22nd May 2024
5. https://electronicscoach.com/category/electronics-instrumentation, accessed on 22nd May 2024
6. https://www.falstad.com/circuit/ , accessed on 22nd May 2024
7. https://www.youtube.com/watch?v=AuZ00cQ0UrE, assessed on 22nd May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Ammeter- 0-20 μA, 0-50 μA, 0-100 μA, 0-200 μA, 0-5 A, 0-10 A
2. Voltmeter- 0-5 V, 0-15 V, 0-30 V, 0-100 V
3. Digital Multi-meter 3 ½ digits
4. Cathode ray oscilloscope- 0 to 30 MHz
5. Function Generator – 0 -5 MHz.
6. Regulated Power Supply - 0-30 V

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.G.K.Awari	I/C HOD, Mechatronics Engineering	Government Polytechnic, Nagpur
2	Ms.A.S.Aghav	Lecturer, Mechatronics Engineering	Government Polytechnic, Nagpur
3	Dr.Hemant B. Warkad	Junior Works Manager	OFA, Yantra India Ltd.,Nagpur
4	Dr.Sachin M.Kale	Lecturer in Electronics and Telecommunication	Government Polytechnic, Amravati
5	Prof.Vikas V.Mankar	I/C HOD, Electronics and Telecommunication	Priyadarshini Polytechnic, Nagpur

(Dr. G. K. Awari)
HOD & Chairman PBOS, MK

(Dr. G. V. Gotmare)
Member Sectretary PBOS, MK

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	DIPLOMA IN CE/ME/EE/EC/PK/MT/MK/AE/TX
Course Category	:	GE
Course Code	:	AI291H
Course Title	:	Python Programming

I Rationale:

Python is commonly used for developing websites and software, task automation, data analysis, and data visualisation. Since it's relatively easy to learn, Python has been adopted by many non-programmers, such as accountants and scientists, for a variety of everyday tasks, like organising finances. Engineering students should know the basics of python programming in open-source environment. Python lab course is designed for students to enrich the knowledge of different Python terminology. After this course student can build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions. Also, students can work with user input to create fun and interactive programs.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Demonstrate proficiency in Python Programming.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Use** basic entities of python in programming.

CO2: **Use** Python data structures for implementing the programs.

CO3: **Develop** Python program using control statements.

CO4: **Develop** Python program for implementing Array and NumPy.

CO5: **Develop** python program to show use of function and modules.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Python	1a	Select the correct syntax from given data type.	1.1	Introduction to Python Programming, Variable and Input, Identifiers and Keywords, Integral Types, Floating Point Types.	CO1
	1b	Choose the correct data type for given variable.	1.2	String Data Type: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods.	
	1c	Identify the correct operator from given operator.	1.3	Operators and Expression in Python, Escape Character and Quotes, Type conversion in python.	
Sequencing in Python	2a	Select the correct method for performing given operation on List.	2.1	Introduction to List: Creating List, Access List Items, Change List Items, Add List Items, Remove List Items, List Methods.	CO2
	2b	Identify the correct Tuple method from given methods to perform given operation.	2.2	Introduction to Tuples: Creating Tuple, Access Tuple Items, Update Tuples, Join Tuples, Tuple Methods.	

UNIT II:	2c	Choose the correct output of Dictionaries program from given output.	2.3	Introduction to Dictionaries: Access Dictionary Items, Change Dictionary Items, Add Dictionary Items.	
UNIT III: Decision Making and Looping in Python	3a	Choose the correct syntax of If Else statement from given syntax.	3.1	Introduction to Decision Making in python programming, Introduction to If, If Else and Else if statement in Python and Neste If.	CO3
	3b	Identify the correct output of Loop from given output.	3.2	Introduction to While Loops: Syntax, working and use of While Loop, programs using While Loop.	
	3c	Select the correct syntax of For loop from given syntax.	3.3	Introduction to For Loop: Syntax, working and use of For Loop, programs using For Loop, Difference between While and For Loop.	
UNIT IV: Python Array and NumPy	4a	Choose the correct method from given methods for performing given operation on Array.	4.1	Introduction to Array: Creating Array, Access Array Items, Add Array Items, Remove Array Items.	CO4
	4b	Select the correct syntax of given statement from given syntax.	4.2	Sort Arrays, Array Methods. Syntax, working and use of break, pass and continue Statements.	
	4c	Suggest the correct method from given methods to perform given operation on NumPy.	4.3	Introduction to NumPy: Uses of NumPy, Array Creation using NumPy Object, NumPy Indexing & Slicing, NumPy Mathematical Functions.	
UNIT V: Python Function and Module	5a	Select the syntax of Function from given syntax.	5.1	Introduction to Python Function, Types of Function. Defining a Python Function, Syntax to Define a Python Function.	CO5
	5b	Choose the correct argument type of python function from given types	5.2	Types of Python Function Arguments: Positional or Required Arguments, Keyword Arguments, Default Arguments.	
	5c	Identify the correct Python Module from given Modules for performing given operation.	5.3	Introduction to Python Modules, Python Built-in Modules, Python User-defined Modules, Creating a Python Module.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Install Python IDE and study various notebooks available for python programming.	2#	CO1
I	2	Explore various option given in python IDE.	2	CO1
II	3	Execute given sample programs for getting familiarity with execution environment.	2#	CO2
II	4	Execute simple Python programs for identify the syntax error.	2	CO2
II	5	Develop & Execute small Python programs to create List.	2#	CO2
III	6	Develop & Execute small Python programs to create Tuple.	2#	CO3
III	7	Develop & Execute small Python programs to create Dictionary.	2#	CO3
III	8	Develop & Execute Python programs based on if else statement.	2#	CO3
III	9	Develop & Execute Python programs on while loop statement.	2#	CO3
III	10	Develop & Execute Python programs on for loop statement.	2#	CO3
IV	11	Develop & Execute programs for creation of Array.	2	CO4
IV	12	Develop & Execute programs for creation of Numpy.	2#	CO4
IV	13	Develop & Execute programs for performing different operation on Numpy.	2#	CO4
V	14	Develop & Execute programs create User Define Function.	2#	CO5
V	15	Develop & Execute programs create User Define Module.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Python	4	C	02	04	04	10
			O	00	00	00	00
2	Sequencing in Python	6	C	04	02	08	14
			O	00	00	00	00
3	Decision Making and Looping in Python	6	C	04	04	06	14
			O	00	00	00	00
4	Python Array and NumPy	8	C	04	04	08	16
			O	00	00	00	00
5	Python Function and Module	6	C	04	04	08	16
			O	00	00	00	00
6			C				
			O				
Total		30	C	18	18	34	70
			O	00	00	00	00

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 01 to Q.35	1R2	1U2	1U2	1A2	1A2	2R2	2R2	2U2	35/35
	2A2	2A2	2A2	2A2	3R2	3R2	3U2	3U2	
	3A2	3A2	3A2	4R2	4R2	4U2	4U2	4A2	
	4A2	4A2	4A2	5R2	5R2	5U2	5U2	5A2	
	5A2	5A2	5A2						

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Writing Program (Execution	5
2	Performance	10
3	Showing Execution Process and outcome	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	3	-	-
CO2	3	-	-	3	-	-	3	-	-
CO3	3	-	-	3	-	-	3	-	-
CO4	3	-	-	3	-	-	3	-	-
CO5	3	-	-	3	-	-	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Python Crash Course: A Hands-On, Project-Based Introduction to programming	Eric Matthes, Nostarch Press, 2nd Edition, 2019	13: 9781593279288
2	Learning Python	Mark Lutz, O'Reilly, 5th Edition, 2013	13: 9780596158064
3	Python Programming	Dr. A R Mahajan, Lambert Academia, 1st edition	13: 9786200652034
4	Head-First Python	Paul Barry, O'Reilly, 2nd Edition, 2016	13: 9781491919538
5	Learn Web Development with Python: Get hands-on with Python	Fabrizio Romano, Packt, 1st edition, 2018	13: 9781789953299

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3. https://www.tutorialspoint.com/python/index.htm accessed on 28th Jan. 2024
4. https://nptel.ac.in/courses/106/106/106106145/ accessed on 25th Jan. 2024
5. https://www.udemy.com/course/python-the-complete-python-developer-course/ accessed on 2nd Jan. 2024
6. https://www.javatpoint.com/python-tutorial accessed on 20th Feb. 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer (Dual Core or above)
2. Network printer.
3. COLAB (Open Source)
4. Any Python IDE

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. R. Mahajan	HOD, Information Technology	Government Polytechnic, Nagpur
2	Dr. Paresh R. Kamble	Machine learning Specialist	Oz Sportz, Nagpur HQ-Reykjavik, Iceland
3	Dr. V. P. Balpande	Associate Professor	Priyadarshani College of Engineering, Nagpur
4	Mrs. Shifa Aziruddin	Lecturer in Information Technology	Government Polytechnic, Gondia
5	Mr. A. G. Barsagade	Lecturer in Information Technology	Government Polytechnic, Nagpur
6	Mr. R. L. Meshram	Lecturer in Information Technology	Government Polytechnic, Nagpur
7	Dr. S. s. Gharde	Lecturer in Information Technology	Government Polytechnic, Nagpur

(Dr. A. R. MAhajan)
HOD & Chairman PBOS, AI

(Dr. G. V. Gotmare)
Member Sectretary PBOS, AI

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/PK/AIML/MT/MK/AE/TX
Course Category	:	GE
Course Code	:	TR291H
Course Title	:	Agro & Rural Tourism

I Rationale:

Agro & Rural Tourism is main component of emerging rural tourism segment worldwide. Tourist are preferring to access the remote area for the leisure and self-connect purpose. Same time tourist are looking to connect with rural India and explore destination in there nearby area for weekend and weeklong duration. This course is a understanding on the concept of Agri and rural tourism management and how individual and use the concept to the business or career option.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Develop an agro tourism project.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** various types of tourism.

CO2: **Identify** the characteristiucs of rural India.

CO3: **Identify** the products of rural and agro tourism.

CO4: **Prepare** an itinerary and costing for rural and agro tourism visit.

CO5: **Prepare** an agro tourism project.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction	1a	Distinguish given types of tourism industry.	1.1	Concept of Tourism, Concept of Agro Tourism, Introduction of Tourism Industry: Domestic/ Inbound/ Outbound.	CO1
	1b	Identify the given componets of agro tourism.	1.2	Types of Tourism: Special Interest Tourism, Introduction of Agro Tourism industry.	

UNIT II: Rural India & Tourism products	2a	Identify the given characteristics of rural India.	2.1	Rural India and its characteristics, Rural, Community Based tourism.	CO2
	2b	Identify different products of rural India.	2.2	Different products and case studies, Culture of Rural India, Ethnic food and culinary tourism, art, craft of rural India.	
	2c	Identify different Agri and Farm Tourism Product.	2.3	Different types of Tourism Product associated with Rural, Agri and Farm Tourism Product and its component,	
	2d	Compare given agri tourisum products in in India and Abroad.	2.4	Tourism products related to Agri farm & Rural tourism products in India and Abroad.	
	2e	Identify different types of events related to rural India.	2.5	Type of Events related to agriculture, Rural and Farm culture. Associating Community with tourism.	
UNIT III: Tourism Product, Itinerary, Costing	3a	Prepare an itinerary for rural and agro tourism.	3.1	Itinerary Preparation	CO3
	3b	Estimate the cost for itinerary for rural and agro tourism.	3.2	Costing of the tourism products, Component supporting the costing of the products etc. Home stay & Rural Stay.	

UNIT IV: Sales & Marketing	4a	Classify the given products according to the target audience and market.	4.1	Classifcation of the product according to the target audience and market.	CO4
	4b	Differetiate between offline and online marketing and promotion.	4.2	Different offline and online marketing and promotional approach.	
	4c	Compare B2B and B2C market approach on given points.	4.3	B2B and B2C market approach.	
	4d	Identify the steps to Lead generation, and Lead conversation.	4.4	Lead generation, Lead conversation.	
	4e	Identify Do’s and Don't before, during and after the tours.	4.5	Do’s and Don't before, during and after the tours. Art to attract repeat customers.	
UNIT V: Tourist behavior	5a	Identify the behavioural characteristics of the tourist at the destination.	5.1	Behaviour of the tourist at the destinations.	CO5
	5b	Identify the behavioural characteristics of the staff at the destination.	5.2	Behaviour of tourism staff, Expectation and outcome of the tour, communication during the tour.	
	5c	Prepare feedback form.	5.3	Feedback and testimonials.	
	5d	Prepare documentation required for registration of agro tourism business.	5.4	Agro Tourism Registration Process, Documentation, Timeline & Fee.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare a List of Best Rural Tourism Destination with Details.	2#	CO1
I	2	Present Best Tourism Activities for the Agro & Rural Tourism Setup.	2#	CO1
I	3	List down and present in class top 10 destination of Domestic Holidays for your family.	2#	CO1
I	4	List down and present in class top 10 destination of International Holidays for your family.	2#	CO1
II	5	Prepare a case study on rural and agro tourism of Vidarbh region.	2#	CO2
II	6	Prepare report on associating community with tourism.	2	CO2
III	7	Prepare an itinerary for agro tourism visit.	2#	CO3
III	8	Estimate the cost for the itinerary for agro tourism visit.	2#	CO3
IV	9	Prepare the Agro Tourism catalog for marketing activity.	2#	CO4
IV	10	Prepare a chart shdepecting the target audience and market.	2#	CO4
IV	11	Prepare a campaign for lead generation and lead conversion.	2#	CO4
V	12	Prepare a feedback form.	2#	CO5
V	13	Prepare documentation for registration of agro tourism business.	2#	CO5
V	14	Prepare Comparison Chart of 5 Best Agro Tourism Center of Vidarbha and Present in Class.	2	CO5
V	15	Prepare One District One Product list of Vidarbha.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction	4	C	4	4	6	14
			O	0	0	0	0
2	Rural India & Tourism products	6	C	2	6	6	14
			O	0	0	0	0
3	Tourism Product, Itinerary, Costing	6	C	2	6	6	14
			O	0	0	0	0
4	Sales & Marketing	8	C	2	6	6	14
			O	0	0	0	0
5	Tourist behavior	6	C	2	6	6	14
			O	0	0	0	0
Total		30	C	12	28	30	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q 1 to Q 35	1R2	1R2	1U2	1U2	1A2	1A2	1A2	35/35
	2R2	2U2	2U2	2U2	2A2	2A2	2A2	
	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	4R2	4U2	4U2	4U2	4A2	4A2	4A2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	10
2	Presentation	10
3	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	3	-	-
CO2	3	-	-	3	-	-	3	-	-
CO3	3	-	-	3	-	-	3	-	-
CO4	3	2	-	3	2	2	3	-	-
CO5	3	2	1	3	2	2	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Perspectives on Rural Tourism Geographies	R S Koster, Springer, 2019	13: 978-3-030-11950-8
2	Sustainable Rural Tourism in Himalayan Foothills	Suneel Kumar, Springer Cham, 2023	13: 978-3-031-40098-8
3	Rural Tourism: Need, Scope and Challenges in Indian Context	Kuldeep Singh, Arnab Gantait, Goldi Puri, G. Anjaneya Swamy 2016	13: 9788184354904

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2. https://www.rural.tourism.gov.in/images/pdf/National%20Strategy%20of%20Rural%20Tourism_May%202022.pdf assessed on 17th May 2024
3. https://maharashtratourism.gov.in/wp-content/uploads/2024/06/Agri-Tourism-Policy.pdf assessed on 17th May 2024
4. https://hwb.gov.wales/api/storage/3f708892-2cfe-4b78-bed2-2ec90ce5fc52/Section1-IntroducingTourism.pdf assessed on 17th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Interactive Smart Board

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. P.P. Virkhare	HOD, Travel and Tourism	Government Polytechnic, Nagpur
2	Mr. Rajesh P. Pund	Lecturer, Travel and Tourism	Government Polytechnic, Nagpur
3	Dr. Aarti Meshram	I/C Principal	GIHMCT, Nagpur
4	Ms. Erika Kar	Director	Pegasus Institute, Nagpur
5	Mr. Adityashekhar Gupta	Director	Horizon Holidays, Nagpur
6	Dr. Arvind Upasani	Visiting Lecturer	RSTM Nagpur University, Nagpur
7	Mr. Vikas Tembhare	Director	DTORR, Nagpur

(Dr. P. P. Virkhare)
HOD & Chairman PBOS, TR

(Dr. G. V. Gotmare)
Member Secretary PBOS, TR

Semester IV

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	AM203H
Course Title	:	Geotechnical Engineering

I Rationale:

Supervision of earthwork in the construction of civil engineering structures like Dams, road embankment and Building foundations is one of the important functions of a technician. This course will develop the basic understanding among the students to ensure the safety , stability in Civil engineering projects such as buildings , dams, embankments, roads, railways, retaining wall, bridges etc.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Analyze soil properties and use it for Civil engineering projects.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Interpret** the physical properties of soil related to construction activities .

CO2: **Use** Atterberg's Limits to identify types of soil.

CO3: **Identify** types of soils using results of permeability.

CO4: **Select** soil strata based on shear strength and cohesion properties of soil.

CO5: **Compute** optimum values for moisture content for maximum dry density of soil through various tests.

CO6: **Interpret** the soil bearing capacity results.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	-	2	2	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
Soil and its physical properties	1a	Describe the salient features of given type of rocks and identify the type of rocks. Illustrate given terms related to soil and its properties.	1.1	Introduction of geology , different branches of geology , importance of geology for civil engineering structures. Definition of a rock , classification based on their genesis, sedimentary and metamorphic rocks. Definition of soil, Importance of soil in engineering & its necessity.	CO1
	1b	Use relation between various soil properties in given situation.	1.2	Mass of Soil, two and three-phase system, properties like void ratio, porosity, degree of saturation, bulk density, dry density, saturated density, specific gravity and water content and Density index. Relation between various properties of soil.	
	1c	List effect of swelling pressure in given clayey soil.	1.3	Introduction to swelling pressure in clayey soil eg. (black cotton soil).	

UNIT I: 1.	1d	Interpret the particle size distribution curve for the given data.	1.4	Classification of soil based on Indian standard classification method. Mechanical analysis – Sieve analysis, grain size distribution curves, characteristic and interpretation, effective size, uniformity coefficient and coefficient of curvature and its significance, well-graded, poorly graded and uniformly graded soil.	
	1e	Illustrate sedimentation analysis for given soil with justification.	1.5	Sedimentation analysis – Stoke's law and principle used in pipette method	
UNIT II: Atterberg's Limits	2a	Calculate Atterberg's limits of Consistency for the given data	2.1	Different types of soil: liquid limit, plastic limit and shrinkage limit and their determination, plasticity index, liquidity index, consistency index.	CO2
	2b	Interpret given plasticity chart.	2.2	Plasticity chart and A-line diagram.	
UNIT III: Permeability	3a	Identify the factors affecting the permeability of given type of soil sample.	3.1	Definition, coefficient of permeability, Darcy's law, typical values of coefficient of permeability for different soil.	CO3
	3b	Compute the coefficient of permeability for a given soil sample data.	3.2	Determination of coefficient of permeability by constant and variable head method.	
	3c	Justify the factors affecting permeability of given soil .	3.3	Various factors affecting permeability & their effect.	
	3d	Use Concept of flow net in the given situation.	3.4	Seepage through earthen structures, seepage velocity, flow net. (no numerical)	
h of Soil	4a	Draw graph and use it for calculating various parameters of shear strength.	4.1	Constituents of shearing resistance of soil, definition of cohesion, internal friction and angle of shearing resistance.	

UNIT IV: Shear Strengt	4b	Draw typical shear failure envelop of given soil.	4.2	Coulomb's law and failure envelop.	CO4
	4c	Calculate Shear strength of soil using given data.	4.3	Shear strength of soil, Different type of tests; Applicability, Numerical based on it.	
	4d	Compare given procedure of shear test with justification.	4.4	procedure for direct shear test and vane shear test.	
UNIT V: Compaction of Soil	5a	Compare process of compaction and consolidation in the given situation.	5.1	Concept of compaction, consolidation, compression and settlement, difference between compaction and consolidation.	CO5
	5b	Compute optimum moisture content and maximum dry density of given soil sample.	5.2	Relation between moisture content and dry density under constant compaction effort, optimum moisture content and maximum dry density. Zero air void line.	
	5c	Compare Proctor Tests for given site situation with justification.	5.3	Light and heavy compaction tests, factors affecting compaction. Standard Proctor Test.	
	5d	Compute field density by core cutter & sand replacement method for given data.	5.4	Field compaction methods, quality control tests, Field density by core cutter, sand replacement.	
	5e	Determine the CBR value of given soil sample.	5.5	California bearing ratio , CBR test, interpretation of C.B.R. value.	
d Soil Stabilization	6a	Suggest the soil parameters to determine bearing capacity of given soil sample with justification.	6.1	Concept of bearing capacity, ultimate bearing capacity, net ultimate bearing capacity, safe bearing capacity, allowable bearing capacity. Typical values of bearing capacity for common soil as per building codes.	

UNIT VI: Bearing Capacity an	6b	Compare methods for determining bearing capacity of soil with justification.	6.2	Plate load test & Standard penetration test–procedure, set-up, limitations .As per Is:1888 & IS:2131	CO6
	6c	Choose relevant method of soil stabilization for the given situation with justification.	6.3	Concept of soil stabilization, necessity of soil stabilization. Different methods of soil stabilization – mechanical stabilization, cement stabilization, bitumen stabilization, fly ash and lime stabilization.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Carryout field identification test on soils.	2#	CO1
I	2	Determine water content of a given soil sample by oven dry method.	2#	CO1
I	3	Determine specific gravity of soil by Pycnometer.	2#	CO1
I	4	Carry out grain size analysis and plot particle size distribution curve for given soil sample.	2	CO1
II	5	Determine Liquid Limit of given soil sample.	2#	CO2
II	6	Determine Plastic limit of given soil sample.	2#	CO2
II	7	Determine shrinkage limitof given soil sample	2	CO2
III	8	Determine coefficient of permeability by falling head test.	2#	CO3
IV	9	Prepare a report on Direct shear test by viewing video recording of test or by Expert lecture.	2#	CO4
V	10	Determine field density and dry density by core cutter method.	2#	CO5
V	11	Determine field density by dry density by sand replacement method.	2#	CO5
V	12	Determine Optimum Moisture Content (OMC) and Maximum Dry Density (MDD) by standard proctor test.	2#	CO5
V	13	Prepare a report on following video recorded test on soil/ Expert lecture. C.B.R. Test.	2#	CO5
VI	14	Prepare a report on following video recorded test on soil/ Expert lecture. Plate load Test.	2#	CO6
VI	15	Prepare a report on following video recorded test on soil/ Expert lecture. Standard penetration Test.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect soil sample from different villages & carryout various test and prepare report.
2. Perform mechanical sieve analysis of different soil samples and draw grain size distribution curve and prepare report.
3. Collect soil samples for determining plasticity index and prepare a report.
4. Prepare plasticity chart & explain it.
5. Compare constant head and variable head method of permeability for different factors.
6. Prepare charts of flow net for different type of soils & justify it.
7. Draw failure envelope for various soils using Cououmb's law .
8. Visit a Road construction site ,study compaction of soil and prepare a report.
9. Study online Plate load test & write procedure and draw setup, also state limitations.
10. Determine MDD and OMC by different methods for any three samples & prepare report.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Soil and its physical properties	8	C	06	00	04	10
			O	06	00	00	6
2	Atterberg's Limits	8	C	06	04	00	10
			O	02	00	04	6
3	Permeability	8	C	02	06	00	8
			O	00	04	00	4
4	Shear Strength of Soil	11	C	00	00	12	12
			O	00	04	04	8
5	Compaction of Soil	12	C	04	04	06	14
			O	00	04	04	8
6	Bearing Capacity and Soil Stabilization	13	C	00	04	12	16
			O	00	04	04	8
Total		60	C	18	18	34	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	2R2	2R2	3R2	5R2	5R2	5	7
2	1R4	1R4	2U4	2R4	3U4			3	5
3	1A4	2A4	4A4	4U4	5U4			3	5
4	5A4	5U4	6U4	6U4	6A4			3	5
5	3U6	4A6	4A6					2	3
6	5A6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing figure/diagram, selection of equipment, writing procedure etc.	5
2	Collection of data/compilation.	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Collection of data.	5
2	Report writing	10
3	Calculation , Result	5
4	Presentation	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	2	3	-	3	3	3
CO2	3	3	-	2	3	-	3	3	3
CO3	3	3	-	2	3	-	3	3	3
CO4	3	3	-	-	3	-	3	3	3
CO5	3	3	-	2	3	-	3	3	3
CO6	3	-	-	-	3	-	3	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Soil Mechanics and Foundation Engineering	Punmia B.C.; Laxmi Publication (P) Ltd.,New Delhi	9788170087915
2	A text book of soil mechanics and foundatin Engineering	Murthy V.N.S.;CBS Publishers & Distributors Pvt. Ltd. , New Delhi2016	9788123913629
3	Geotechnical Engineering (Soil Mechanics)	Ramamurthy T.N. & Sitharam T.G.; S Chand and Company Ltd., New Delhi	9788121924573
4	Principles of Geotechnical Engineering	Braja M. Das ;Cengage Learning	9789355738103

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2. https://theconstructor.org/geotechnical/specific-gravity-soil-pycnometer-procedure-calculations/2677/ ; accessed on 20th May 2024
3. https://theconstructor.org/geotechnical/dry-density-of-soil-by-core-cutter-method/2680/https://theconstructor.org/geotechnical/dry-density-of-soil-by-
4. https://theconstructor.org/practical-guide/in-situ-dry-density-sand-replacement-method/2687/;accessed on 20th May 2024
5. https://in.video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=Determination+of+Liquid+limit+and+plastic+limit+of+soil&type=E210IN
6. https://in.video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=Direct+shear+test+of+soil+vidieo&type=E210IN1494G0#id=2&vid=55a
7. https://in.video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=Determination+of+MCC+and+OMD+of+soil&type=E210IN1494G0#id=1
8. https://in.video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=California+bearing+ratio+test&type=E210IN1494G0#id=1&vid=fb8ba62
9. https://in.video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=plate+load+test+for+soil&type=E210IN1494G0#id=2&vid=ba1e5c04c4e
10. https://www.constructioncivilengineering.com/standard-penetration-test.html ;accessed on 20th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Proctor compactometer for light and heavy compaction.
2. 425 micron IS sieve and 100 ml capacity graduated glass cylinder.
3. Oven thermostatically controlled to maintain temperature of 110 degree celcius to 115 degree celcius.
4. Pycnometer- consisting of 1 kg jar with plastic cone, locking ring and rubber seal.
5. Core cutter apparatus - cylindrical core cutter of steel 100 mm dia x 127.3 mm high with 3mm wall thickness .
6. Sand replacement apparatus- as per IS:2720 (part-28)
7. Mechanical sieve shaker- carries uo to 7 sieves of 15 cm to 20 cm dia.(as per IS 2720 part 4 1985)
8. Casagrande liquid limit apparatus- as per IS:9259-1979
9. Constant head and falling head permeameter- as per IS: 2720(part-4)1986
10. Direct shear test apparatus- as per IS;2720(part13)1986

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	H.L. Wahane	Lecturer	Government Polytechnic, Nagpur
2	R.D. Dongarwar	Lecturer	Government Polytechnic, Nagpur
3	Abdul Ateeque Azher	Lecturer	Government Polytechnic, Nagpur

(Dr. D.K. Parbat)
HOD & Chairman PBOS,

(Dr. G.V. Gotmare)
Member Sectretary PBOS,

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	AM204H
Course Title	:	Theory of Structures

I Rationale:

Civil engineering structures are mainly made-up of column, Beam and Slabs and these structures are subjected to axial as well as eccentric loading along with different end conditions. Through analysis, students learn to assess stresses in vertical members, analyze beam slope and deflection, determine end moments in fixed beams, analyze continuous beams using principles like the three-moment equation and Moment Distribution method, and draw Shear Force & Bending Moment Diagrams for both fixed and continuous beams.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Analyze the structure for shear stresses, bending stresses, slopes and deflections.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Analyze** stresses induced in vertical members subjected to direct and bending loads.

CO2: **Calculate** direct & bending stresses at the base of dam and retaining wall.

CO3: **Calculate** slope and deflection in beams under different loading conditions.

CO4: **Draw** shear force and bending moment diagram for fixed beam.

CO5: **Analyze** continuous beam under different loading conditions using principle of three moments.

CO6: **Analyze** continuous beam using Moment DIstribution method.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	-	-	2	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	-	-	-	-	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Direct and Bending stresses	1a	Illustrate given term related to direct and bending stresses.	1.1	Concept of axial and eccentric load. Eccentricity about one or both Principal axes, stress distribution diagram and nature of stress.	CO1
	1b	Calculate conditions for no tension at the base of given structure on given data.	1.2	Condition for no tension, limits of eccentricity, Maximum & Minimum stresses, core section for square, Rectangular and circular section.	
	1c	Analyze stresses in the section of given structure using given data.	1.3	Short columns, walls, Pillars and Chimney subjected to wind pressure.	
UNIT II: Dams and retaining wall	2a	Calculate direct and bending stresses related to given structure.	2.1	Definition of dam and retaining wall, Maximum and minimum stresses of Rectangular dams and trapezoidal dams with water face vertical. Conditions for stability of dam.	CO2

UNIT III: Slope and deflection	3a	Illustrate given term related to slope,and deflection of beam.	3.1	Concept of slope and deflection, stiffness of beams., Flexure rigidity of beams.	CO3
	3b	Calculate slope and deflection of given beam.	3.2	Slope and deflection of beam subjected to pure bending. Relation between slope, deflection and radius of curvature, differential equation.	
	3c	Calculate slope and deflection by given methods.	3.3	Double integration and Macaulay's method of calculation of slope and deflection. to simply supported beams subjected to concentrated loads.	
	3d	Draw shear force & bending moment diagram for given beam.	3.4	Propped cantilevers, reactions of prop, shear force & bending moment diagram for rigid propped cantilever.	
UNIT IV: Fixed Beam	4a	Find fixed end moments of given fixed beam.	4.1	Concept of fixity, effect of fixity, advantages and disadvantages of fixity, fixed end Moments, nature of fixed end moments, principle of super position.	CO4
	4b	Draw Shear Force & Bending Moment diagram for given fixed beam.	4.2	Formulae for Fixed end Moments for concentrated load and uniformly distributed load(UDL) on entire span, Application in Drawing Bending moment diagram & Shear force diagram for fixed beam subjected to concentrated load, Uniformly distributed load over entire span.	
m	5a	Illustrate given term related to continuous beam.	5.1	Defination and effect of continuity, nature of moments induced due to continuity, concept of deflected shape.	

UNIT V: Continuous Bea	5b	Find fixed end moments of continuous beam under various load of given data.	5.2	Clapeyron's theorem of three moments, application up to two spans only. Supports at the same level, spans may be equal or unequal, Moment of Inertia same for one span and may be different for other span.	CO5
	5c	Analyze continious beam using three moments theorem.	5.3	Calculation of Shear force and Bending Moment for concentrated load and Uniformly distributed load on entire span.	
UNIT VI: Moment Distribution Method	6a	Illustrate given terms related to moment distribution method.	6.1	Introduction, Sign convention, carry over factor, stiffness factors, distribution factor.	CO6
	6b	Analyze continious beam using Moment distribution method.	6.2	Application of moment distribution method to various types of continuous beam subjected to concentrated load and UDL over entire span for Rigid supports at same level.Shear force diagram & Bending moment diagram for above application.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)	Hours	Aligned COs

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect the data of existing structures where direct and bending stresses have a predominant role (for example: Leaning of tower Pisa) and prepare report.
2. Measure maximum deflection in a simply supported beam in laboratory. Check the results using analytical method.
3. Compare fixed beam with simply supported beam of same span and loading and prepare report.
4. Analyse given continuous beam using different method and compare the results.
5. Collect the data from You tube/videos showing change in deflected shape due to change in number of supports in a beam and prepare report.
6. Draw the Shear force and Bending moment diagram using Fixed beam method for different examples.
7. Draw the Shear force and Bending moment diagram using Clapeyron's theorem of three moments for different examples.
8. Draw the Shear force and Bending moment diagram using Moment distribution method for different examples.
9. Compare slope and deflection of simply supported beam for same span subjected to different types of loadings.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Direct and Bending stresses	10	C	02	04	06	12
			O	02	04	00	6
2	Dams and retaining wall	6	C	04	04	00	8
			O	04	00	00	4
3	Slope and deflection	10	C	02	04	06	12
			O	00	00	06	6
4	Fixed Beam	10	C	02	08	04	14
			O	02	04	04	10
5	Continuous Beam	12	C	02	04	06	12
			O	00	00	06	6
6	Moment Distribution Method	12	C	02	00	10	12
			O	00	04	04	8
Total		60	C	14	24	32	70
			O	8	12	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	3R2	4R2	5R2	6R2	1R2	4R2	5	7
2	2R4	1U4	2U4	2R4	1U4			3	5
3	3U4	4U4	4U4	4U4	6U4			3	5
4	5U4	4A4	6A4	6A4	4A4			3	5
5	1A6	3A6	3A6					2	3
6	5A6	6A6	5A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of topic	5
2	Calculations, result, graph (if any)	10
3	Report writing	10
4		
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	-	3	-	3	-	-
CO2	3	3	-	-	3	-	3	-	-
CO3	3	3	-	-	3	-	3	-	-
CO4	3	3	-	-	3	-	3	-	-
CO5	3	3	-	-	3	-	3	-	-
CO6	3	3	1	-	3	-	3	1	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Theory of Structure	R. S. Khurmi, S. Chand& Company, Edition,2015	10:8121905206
2	Theory of Structure	R. Ramamurtham Dhanpat Rai& Co(P) Ltd Edition,2015	9782000000037
3	Theory of Structure	B.C. Punmia ,Laxmi Publication 2015	9788170086185
4	Theory of Structure	S.P.Gupta Tata McGraw Hill, Edition, 2015	10;0074634984 13;9780074634981
5	Theory of Structure	N. S. Vazirani, Khanna Publication, Edition and Year Of publication	10;8174091424 13;9788174091420

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2. https://www.youtube.com/watch?v=zdLV42DbtNI assessed on 22/05/2024
3. https://www.youtube.com/watch?v=K8yvy3cB9aM assessed on 22/05/2024
4. https://www.youtube.com/watch?v=RQdlfImyMq0&list=PLIhUrsYr8yHz_WM0pgyr_ATRzYiLxkVPe assessed on 22/05/2024
5. https://www.youtube.com/watch?v=xIVBJ2U3iyM assessed on 22/05/2024
6. https://www.youtube.com/watch?v=mqe9y35uTcM assessed on 22/05/2024

XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. S. R. Kukadapwar	Head of Applied Mechanics	Government Polytechnic, Nagpur
2	Mr. R. D. Dongarwar	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur
3	Mr. H. L. Wahane	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur
4	Mr. A. A. Azher	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur
5	Er. G. B. Takey	Retd. EE, Vigilance & Quality Control	PWD, Nagpur
6	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg. Nagpur
7	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE203H
Course Title	:	Maintenance & Repairs of Structures

I Rationale:

Regular inspection and maintenance is necessary for timely identification of deteriorated building elements. The civil engineering technologists are required to prevent the deterioration of different types of buildings and also to repair the damages in the building with scientific approach which enhance the life of structures and provide safety. This course is therefore designed to develop the competency to do all these activities.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of civil engineering to rehabilate the structures.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** the relevant method of maintaining different building structures in given situation.

CO2: **Predict** the stability of structure using given test.

CO3: **Repair** of structures using given material.

CO4: **Repair** for the masonry structures using given method.

CO5: **Restore** the damages of building structural elements using suitable method of repair.

CO6: **Determine** the structural audit and budget for the maintenance of structures.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	-	2	2	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Basics of maintenance and repairs	1a	Suggest the necessity of maintenance and repairs of the civil structure.	1.1	Maintenance and its classifications, repair, retrofitting, re-strengthening, rehabilitation and restoration. Necessity, objectives and importance of maintenance and repairs.	CO1
	1b	Identify the factors that influence on maintenance of given structure with justification.	1.2	Factors influencing the maintenance and repairs. Advantages and limitations of maintenance and repairs.	
	1c	Identify the concept of retrofitting, re-strengthening, rehabilitation, and restoration.	1.3	Approach of effective management for maintenance and repairs.	
	1d	Identify the periodical maintenance and its manual, monsoon maintenance, maintenance history sheet.	1.4	Periodical maintenance, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, pre and post monsoon maintenance.	

UNIT II: Causesand detection of damages	2a	Identify the causes of damages occurred in the given structures.	2.1	Common defects and failures with possible causes in Building, Roads, Bridges, Water supply and Sewerage scheme, canal and Cross Drainage (CD) works.	CO2
	2b	Suggest non-destructive test with respect to the given damaged structural elements	2.2	Material used for different repairs Epoxy resin, Epoxy mortar, polypropylene, poly-sulphate, silicon,gypsum cement mortar, polymer concrete, fiber reinforce concrete. Etcobservations for detection of damages.	
	2c	Suggest the procedure of non-destructive test used to detect the damages.	2.3	Tests on damaged structures: rebound hammer, ultrasonic pulse velocity, rebar locator, cover gauge, crack detection microscope, chloride test, sulphate attack, pH measurement, half- cell potential meter.	
ntenance and repairs	3a	Select the relevant materials to repair the given type of damages with justification.	3.1	Factors influencing the material selection for maintenance and repairs. Anti-corrosion coating materials: cement slurry mortar, polymer modified cement slurry and epoxy zinc.	
	3b	Suggest the suitable materials for the anti-corrosion, adhesives and mortar repairs.	3.2	Adhesives materials: solvent free adhesives: epoxy adhesive, polyester adhesive, acrylic adhesive and water borne adhesives: polyvinyl acetate and vinyl acetate co-polymer.	

UNIT III: Materials for mair	3c	Suggest the relevant materials for waterproofing, and joint sealants for the repairing of given structure.	3.3	Grout materials: cement grout, cement sand grout, cement sand grout with additives, polymer modified cement grout and normal epoxies. Waterproofing roof materials: poly-isobutylene (PIP) sheet, glass fiber reinforced plastics, bitumen and bituminous emulsion and latex cement coating.	CO3
	3d	Select the relevant materials for surface coating and grout for the repairing of given structure.	3.4	Surface coating materials for concrete protection: bituminous cuthacks, chlorinated rubber coating, Vinyl coatings, epoxy coating and coal tar epoxy	
UNIT IV: Maintenance and repair methods for masonry	4a	Identify the various causes of wall cracks and their probable locations	4.1	Causes of wall cracks , Stages of repair, Repair techniques: grouting, patch spalling replacement or delaminating and epoxy bonded mortar.	CO4
	4b	Select the relevant repair techniques for the damages in the given civil structures with justification.	4.2	Repairing methods for minor & medium cracks include epoxy injection, grooving & sealing, shotcrete, stitching, grouting and guniting.	
	4c	Suggest the repairing methods for the different crack types for the given structure.	4.3	Repairing methods for major cracks (width more than 5mm) include fixing mesh across cracks, dowel bars, RCC band and installing ferro-cement plates at corners and propping.	
	4d	Identify the various methods of improving the bearing capacity of foundation	4.4	Effects of dampness in wall, damping repair techniques , Causes and remedies of foundation settlement, improvement techniques	

UNIT V: Maintenance and repair methods for RCC	5a	Identify the probable crack location in RCC and causes of RCC failure.	5.1	Probable location of cracks m RCC elements, various causes of RCC failure. Repair methods for cracks m RCC structures such as epoxy injection, grooving & sealing, stitching, rebaring, grouting, spalling replacement, jacketing, shotcrete and gunitting.	CO5
	5b	Identifythe repair of corroded RCC elements.	5.2	Repair of corroded RCC element: exposing and undercutting rebar, cleaning reinforcing steel, compensating reinforcement and protective coating.	
	5c	Select proper method for honeycomb and large voids in the given structure.	5.3	Repair methods for honeycomb and larger voids.	
UNIT VI: Structural audit and Budget	6a	Justify the necessity and importance of structural audit & budget estimation.	6.1	Necessity and importance of structural audit and budget estimation. Distress survey ,detailed inspection. Recommendations for budget estimation, Steps involved in structural audit and budget estimation.	CO6
	6b	Prepare the formats for the process of structural audit and budgeting.	6.2	Various formats for preparation for structural audit including general information of building, building data, complaints reported by users, inspection of internal and external areas of building.	
	6c	Identify the rules & regulations of structural audit and budget estimation as recommended by competent authority.	6.3	Overview on rules and regulations of structural audit and budget estimation as recommended by competent authority such as Public Work Department.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the causes of damages for the given building elements.	2#	CO1
I	2	Prepare the check list for materials required for repair of load bearing building and framed building.	2#	CO1
I	3	Prepare a check list for repair of a load bearing building and framed building.	2#	CO1
II	4	Determine the compressive strength of structural elements such as column, beam, slab etc for damaged or undamaged structure using Rebound Hammer.	2#	CO2
II	5	Determine the extent of efflorescence in masonry or concrete for damaged or undamaged structure.	2	CO2
II	6	Determine the crack nature of structural elements such as column, beam, slab etc. for damaged structure using Ultrasonic Pulse Velocity test.	2#	CO2
II	7	Determine the bond strength of structural element such as column, beam, and slab etc. using pull out test.	2#	CO2
II	8	Determine the size, depth and location of reinforcing bar using Rebar locator of structural elements such as column, beam, slab etc. for damaged or undamaged structure	2#	CO2
II	9	Determine Maximum Chloride content in concrete in percent by weight of cement using Rapid Chloride Test of structural element such as column, beam, slab etc for undamaged structure.	2	CO2
II	10	Determine the depth of carbonation of concrete using phenolphthalein indicator of structural elements such as column, beam, slab etc. for undamaged structure.	2#	CO2
II	11	Determine the moisture content using Moisture Meter of structural elements such as column, beam, slab etc. for damaged or undamaged structure.	2#	CO2

II	12	Determine the corrosion of reinforcing bar using Half-cell Potentiometer of structural elements such as column, beam, slab etc for damaged or undamaged structure.	2#	CO2
II	13	Determine the compressive strength of extractor core using Compression Testing Machine of structural element such as column, beam, slab etc. for damaged or undamaged structure.	2	CO2
III	14	Prepare a list of material requirements and checklist for repair of wall cracks as per the damages found.	2#	CO3
IV	15	Prepare a report on damage assessment of non-residential structures such as dams, bridges, industrial buildings etc.	2*	CO4
IV	16	Prepare a checklist for repair and material requirement for flooring of given structure.	2*	CO4
IV	17	Prepare a check list for materials required and resources for repair of sanitary unit of the building.	2*	CO4
V	18	Prepare a budget estimation considering materials, task force, equipment's and methodology for the given damaged structure.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a report on various cracks observed in any one building in your campus.
2. Prepare report on various defects in civil engineering structures.
3. Prepare a report on restoration of ceiling cracks of the given building.
4. Prepare a report on restoration of reinforcement damage in columns and beams of the given building.
5. Prepare a report by visiting a shop on materials used for repairs of structure with its images and brands.
6. Prepare a report on compressive strength of various components of the existing building with rebound hammer.
7. Prepare a report on various anti-corrosion coating materials.
8. Prepare a report on various adhessive materials.
9. Prepare a report on grouting method.
10. Prepare a report on various cracks observed in building.
11. Prepare a report on maintenance of major cracks observed in building.
12. Prepare a report on maintenance of honey comb observed in structures.
13. Prepare a report on structural audit.
14. Prepare a report budget of maintenance of structures.
15. Prepare a report on rules and regulation used for structural audit and budget estimation.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Basics of maintenance and repairs	3	C	06	00	00	6
			O	00	04	00	4
2	Causesand detection of damages	5	C	02	04	06	12
			O	00	00	06	6
3	Materials for maintenance and repairs	6	C	02	08	04	14
			O	00	04	04	8
4	Maintenance and repair methods for masonry	6	C	00	08	06	14
			O	04	00	06	10
5	Maintenance and repair methods for RCC	5	C	02	04	06	12
			O	02	04	00	6
6	Structural audit and Budget	5	C	02	04	06	12
			O	02	04	00	6
Total		30	C	14	28	28	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	5R2	6R2	5R2	6R2	5	7
2	1R4	2U4	3U4	1U4	3U4			3	5
3	3U4	3A4	4U4	3A4	4R4			3	5
4	4U4	5U4	6U4	5A4	6A4			3	5
5	2A6	4A6	2A6					2	3
6	5A6	6A6	4A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing , selection of equipment	5
2	Performance / OBSERVATIONS	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Problem given	5
2	Performance / OBSERVATIONS	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	3	-	-	-	3	-
CO2	3	3	-	3	-	-	-	3	-
CO3	3	3	-	3	-	-	-	3	-
CO4	3	3	-	3	-	-	-	3	-
CO5	3	3	-	3	-	-	-	3	-
CO6	3	3	1	3	-	-	-	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Maintenance and Repairs of Building.	P.K. Guha. New Central Book Agency.	10: 8173813558 13: 978-8173819559
2	Maintenance Engineering For Civil Engineering.	B.S. Nayak, Khanna Publisher.	10: 978-81-7409-051-5
3	Building Maintenance.	Ivor H.Seeley,Redwood Burn Ltd, Throwbridge and Esher.	10: 0333171608 13: 978-0333171608
4	Maintenance and Repairs of Buildings.	Hutchin Son, B D.	0408001917

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2. https://www.aalimec.ac.in/wp-content/uploads/2020/03/UNIT-1.pdf.
3. https://civil.iitm.ac.in/admin/civilcont/W1%20-%20L0%20-%20MRCS%20-%20Prologue.pdf.
4. https://www.researchgate.net/publication/287063718_Maintenance_and_Repair.
5. https://ecajmer.ac.in/facultylogin/announcements/upload/RRS%20ppt.pdf.

XVI List of Major Equipment/Machineries with Specification:

1. Rebound Hammer
2. Ultrasonic Pulse Velocity
3. Universal testing machine (UTM)
4. Compression testing machine (CTM):
5. Cover gauge (Battery Powered):
6. Rapid Chloride test apparatus
7. Crack detection microscope
8. Rebar locator
9. Moisture meter; Water permeability meter:
10. Half cell potentiometer; Extensometer (Least count 0.01 mm):

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. P. Mogre	Principal	Government Polytechnic, Nagpur
2	Dr. D. K. Parbat	Head, Civil Engineering	Government Polytechnic, Nagpur
3	Dr. S. J. Nikam	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
4	Dr. B. R. Ambade	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
5	Er. G. B. Takey	SE, Vigilance & Quality Control	J. L. Priyadarshini College PWD, Nagpur
6	Dr. Abhay Shende	Principal	Priyadarshini J. L. COE, Nagpur
7	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSE
Course Code	:	CE204H
Course Title	:	Railway Engineering

I Rationale:

Railway Engineering is an important aspect of Civil Engineering as they are very crucial in shortening the distance of travel. Efficient and Effective network of different modes of transportation plays an important role in the Nation's economic progress and its integration. The basic requirements of efficient transportation are speed, safety and comfort. This course is intended to develop the basic skills related to investigation, surveys, alignment, construction and maintenance of Railway track.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Manage and supervise railway transportation system and infrastructure

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the role of railways in National development

CO2: **Identify** the components of Railway Tracks

CO3: **Suggest** type of Sleepers, Ballast, and Rail fixtures used in railway construction

CO4: **Suggest** the Alignment of Railway Track and maintain the point and crossing

CO5: **Identify** the type of railway station and yards.

CO6: **Identify** the tools required and duties of personnels related to track maintenance activities.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Railway Engineering	1a	Analyse development of railways, in India.	1.1	History of development of railways, in India,Railway: Zones of Indian railways,	CO1
	1b	Justify the given use of railways.	1.2	Merits and demerits of roadway and railway	
	1c	Justify the use of Metro and Monorail, Bullet Train.	1.3	Introduction to Metro and Monorail, Bullet Train.	
nponents of railway track:	2a	Identify the components of railway track in the given cross section of track.	2.1	Components of railway track: Rails, ideal requirements of railway track, types of Rails, Rail Gauge; types, factors affecting selection of a gauge, tilting of rails and coning of wheels. Rail Joints :Necessity, types : requirements of welded joints. Creep ofrail: Definition, causes and prevention of creep.	CO2
	2b	Suggest the types of sleepers provided for the specified railway track with justification.	2.2	Sleepers: Requirement, functions and types, sleeper density	

UNIT II: Con	2c	Propose the relevant type of ballast to beprovided in specified railway track with justification	2.3	Ballast: requirement, function, types, suitability	
	2d	Identify the fixtures with fastening provided in the given rail section.	2.4	Rail fixtures and fastenings: fish plate, spikes, bolts,keys, bearing plates, chairs , types of anchors and anti-creepers.	
UNIT III: Track Geometrics	3a	Fix the alignment of given railway track laid on typical terrain.	3.1	Alignment: Factors governing rail alignment.	CO3
	3b	Identify the given component of the cross section of the track.	3.2	Cross sections of Track : Important technical terms: permanent land width/right of way, formation width, side slopes, side drains. Standard cross section of single and double line in cutting and in embankment.	
	3c	Identify factors affecting railway track geometrics	3.3	Railway Track Geometrics: types and factors affecting of, Gradient, curves, grade compensation, super elevation: limits of Super elevation on curves, negative cant, cant deficiency.	
UNIT IV: Points and Crossings	4a	Draw sketch of turnouts, points, and crossings w.r.t railway track.	4.1	Branching of Tracks: Points and crossings: Turn out:left and right-hand turnout, components, and their functions.	CO4
	4b	Compare given cross over on the basis of given points.	4.2	Important technical terms, track junctions: crossovers, scissor cross over, diamond crossing, track triangle.	
lway Station and Yard	5a	Select the relevant type of railway station for specific purpose.	5.1	Railway Station, Purpose, requirement of railway station, factors affecting site selection for railway station, Important technical terms, types of railway station.	CO5

UNIT V: Rail	5b	Classify the given type of station yard in railway engineering.	5.2	Station yard: Function, Classification: Passenger, goods, locomotive and marshalling yards: draw backs of marshalling yards.	
UNIT VI: Maintenance of rail track	6a	Identify given tools required for track maintenance with their function	6.1	Track maintenance, Necessity, Classification, Tools required for track maintenance with their function	CO6
	6b	Identify duties of given rail track maintenance personnel.	6.2	Organization of track maintenance, Duties of permanent way inspector, gang mate and key man.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare report on History of development of railways, in India	2#	CO1
I	2	Prepare report on Zones of Indian railways,	2#	CO1
I	3	Identify Merits and demerits of roadway and railway and prepare report	2#	CO1
I	4	Prepare report on field visit to metro station.	2	CO1
II	5	Prepare report on visit to railway track.	2#	CO2
II	6	Draw different fixture and fastener used Rail in track	2	CO2
II	7	Draw different sleepers used Rail in track	2#	CO2
III	8	Draw labled Cross sections of railway track of single and double line in cutting.	2#	CO2
III	9	Draw labled Cross sections of railway track of single and double line in embankment.	2#	CO3
IV	10	Draw labled sketches of Points and crossings: Turn out: left and right-hand turnout, double line in cutting.	2#	CO4
IV	11	Draw labled sketches of Points and crossings: Turn out: left and right-hand turnout, double line in embankment.	2	CO4
IV	12	Draw labled sketches of crossovers, scissor cross over, diamond crossing, track triangle.	2#	CO4
V	13	Prepare report on field visit to railway station and yard.	2#	CO5
VI	14	Draw figures of Tools required for track maintenance with their function	2#	CO6
VI	15	Prepare a report on use of IoT in Railway engineering.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a report on History of Railway in India
2. Prepare an organization chart for Indian railways
3. Compare different mode of transports available in city.
4. Prepare a report on advanced railway signals.
5. Visit to railway track and identiy different fixture and fasteners.
6. Prepare a report on Nagpur metro.
7. Prepare a report on Railway facilities in Nagpur city.
8. Prepare a report on future rail technology.
9. Prepare a report on advanced railway track construction machinery
10. Vist to railway station and yard to study duties and resposibilitis of different personnel working at railway station and yard.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Railway Engineering	3	C	00	04	00	4
			O	02	00	00	2
2	Components of railway track:	12	C	04	08	06	18
			O	00	04	06	10
3	Track Geometrics	10	C	02	08	06	16
			O	06	04	00	10
4	Points and Crossings	8	C	02	04	06	12
			O	00	00	06	6
5	Railway Station and Yard	6	C	04	00	06	10
			O	00	04	00	4
6	Maintenance of rail track	6	C	02	00	08	10
			O	00	04	04	8
Total		45	C	14	24	32	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	5R2	1R2	2R2	5	7
2	1A4	2U4	2A4	2A4	4A4			3	5
3	2A4	3U4	3A4	4A4	5A4			3	5
4	4U4	5R4	6A4	5R4	5A4			3	5
5	4A6	5U6	3U6					2	3
6	5A6	6A6	6U6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	5
2	Observation and recording	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce.	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Topic.	5
2	Active participation.	5
3	Interpretation of observation.	10
4	Report submission.	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	3	3	3	3	-
CO2	3	-	-	-	3	3	3	3	-
CO3	3	-	-	-	3	3	3	3	-
CO4	3	-	-	-	3	3	3	3	-
CO5	3	-	-	-	3	3	3	3	-
CO6	3	-	-	-	3	3	3	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Road, Railways, Bridge and Tunnel Engg	Birdi, Ahuja, Standard Book House, 16th Edition, March 2010	13:978-8189401337
2	A text book of Railway Engineering S.C. Saxena, S P A text book of Railway Engineering	S.C. Saxena, S P Arora, Dhanpat Rai Publications (p) Ltd. 8th Edition , 2010	13:978-8189928834
3	Roads, Railways, Bridges, Tunnels and Harbour Dock Engineering	B L Gupta, Standard Publishers. 5th Edition ,2015	13:9788180140099
4	Road, Railway, Bridge and Tunnel Engineering	T D Ahuja and G S Birdi, Standard book house, 16th Edition , 2012	13:9788189401337

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2. https://nptel.ac.in/courses/105107123 accessed on 1st Nov , 2024
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4. http://kcl.digimat.in/nptel/courses/video/105107463/L63.html accessed on 1st Nov , 2024
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XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	HOD, Civil Enguineering	Government Polytechnic, Nagpur
2	Dr. S. J. Nikam	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mr. R. M. Walke	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	Executive Engineer, Vigelence and Quality Control	P.W. D Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshani College Of Engineering, Nagpur
6	Dr. V. G. Kondekar	HOD, Civil Engineering	Government Polytechnic, Sakoli

(Dr D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSE
Course Code	:	CE205H
Course Title	:	Traffic Engineering

I Rationale:

Traffic engineering is an important aspect of all modes of transportation. Due to the abundant growth in population and infrastructure development, there is urgent need to pay the immediate attention to the certain issues like designing traffic control device installations and modifications, including traffic signals, signs, and pavement markings. Also it is important for safety of vehicle users as well as pedestrians. This course is expected to develop knowledge of performing various traffic surveys, analyze and interpret the data and provide the solutions in the form of traffic controlling devices. The civil engineering diploma holders have to do the related construction and maintenance activities of the structures made for guiding the traffic

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Execute the working and control of traffic engineering elements**.**

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the road traffic characteristics.

CO2: **Perform** road traffic studies.

CO3: **Suggest** the relevant road traffic signs and markings.

CO4: **Justify** the relevant road signals for the road intersection.

CO5: **Maintain** the road environment.

CO6: **Suggest** preventive measures to avoid accidents by analyzing the traffic conditions at site.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Fundamentals of Traffic Engineering.	1a	Justify the characteristics of road users in the given situation	1.1	Traffic engineering- Definition objects, scope Road user's characteristics-physical, mental, emotional factors.	CO1
	1b	Analyse the vehicular characteristics for the given situation	1.2	Vehicular characteristics-width, length, height, weight, speed, efficiency of break.	
	1c	Analyse the road characteristics for the given situation	1.3	Road characteristics-gradient, curve of a road, design speed, friction between road and tyre surface.	
	1d	Justify the factors affecting the reaction time for the given situation.	1.4	Reaction time- factors affecting reaction time. PIEV Theory.	

UNIT II: Traffic Studies	2a	Analyse the given traffic data	2.1	Traffic Studies -types, purpose, Information required for traffic studies. Traffic volume study-definition purpose. Methods of collection of traffic volume count data-manual, automatic recorders, moving car method.Traffic volume count data-representation and analysis of data.	CO2
	2b	Analyse origin-destination studies data collected for the given road	2.2	Necessity of Origin and Destination study and its methods.	
	2c	Analyse spot speed study data collected for the given road	2.3	Speed studies-spot speed studies, and its presentation,	
	2d	Compare given parking systems on given points.	2.4	Need and method of parking study.	
UNIT III: Road Markings and Traffic Signs	3a	Interpret the traffic signs at the given road intersection or road.	3.1	Traffic control devices -definition necessity, types. Road signs-definition, objects of road signs.	CO3
	3b	Justify the necessity of pavement markings for given road and road intersection.	3.2	Road markings-definition.Classification of Road markings carriage way, kerb, object marking and reflector markers.(IRC- 35)	
	3c	Suggest the traffic signs for given traffic situation with justification.	3.3	Classification as per IRC: 67-1977-Mandatory or Regulatory, Cautionary or warning, informatory signs Location of cautionary or warning sign in urban and non-urban areas, Parameters to be considered while designing the road signs. Points to be considered while erecting the road signs.	

UNIT IV: Traffic Signals and Traffic Islands.	4a	Justify the necessity of given traffic signal at the inter section of a road.	4.1	Traffic signals- Definition, Types of signals-Traffic control signals, pedestrian signals, special type of traffic signals. Smart traffic signals.	CO4
	4b	Use the principle of coordinated signals on the given road section.	4.2	Types of traffic control signals. Fixed time, manually operated, traffic actuated signals, Location of signals, Compute signal time by fix time cycle, trail cycle, approximate, Webster's and IRC method and sketch timing diagram for each face.	
	4c	Categorize the existing traffic island at the given road intersection.	4.3	Traffic islands -Definition, advantages and disadvantages of providing island. Types of traffic islands-rotary or central, channelizing, Refuge Island.	
	4d	Suggest the relevant measures to guide the traffic in the given situation with justification.	4.4	Road intersections or junctions-: Definition, Types of road intersection. Intersection at grade- Types, basic requirements of good intersection at grade. Grade separated intersection,- advantages and disadvantages, types- of flyovers- Cloverleaf pattern- full and half, Trumpet type, underpass. Segregation of traffic-Definition, purpose. types.	
V: Road Environment and Arboriculture	5a	Suggest the street lighting system for the given road section.	5.1	Street lighting -definition, sources necessity, types- luminaire, foot candle, lumen, factors affecting their utilization and maintenance. Factor affecting visibility at night.	CO5
	5b	Recommend the relevant type of trees for road side plantation.	5.2	Arboriculture- definition, objectives, factors affecting selection of type of trees.	

UNIT	5c	Justify the need of protecting the road side plantation.	5.3	Maintenance of trees-protection and care of road side trees	
UNIT VI: Road Accident Studies	6a	Analyze the causes of accident occurred on the given road section.	6.1	Road accidents- Definition, types. Collision and non-collision accidents.Causes of accidents.	CO6
	6b	Suggest preventive measures to avoid the accidents on the given road section.	6.2	Measures to prevent road accidents.Reporting and recording of an accident.Collision and condition diagram.	
	6c	Prepare the plan for traffic rules awareness programme and laws at selected location.	6.3	Consideration regarding road saftey.Legislation and Law enforcement education and propaganda.	
	6d	Justify the need of IoT In traffic management system	6.4	Future trends in Traffic management system using IoT.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the road traffic characteristics for any existing road.	2#	CO1
II	2	Measure the traffic volume in morning peak hours to analyze traffic composition on road way.	2#	CO2
II	3	Measure the traffic volume in evening peak hours to analyze traffic composition on road way.	2	CO2
II	4	Measure the traffic volume in non peak hours to analyze traffic composition on road way.	2	CO2
II	5	Measure the traffic volume in morning peak hours to analyze traffic composition at Intersection.	2#	CO2
II	6	Measure the traffic volume in evening peak hours to analyze traffic composition at Intersection.	2	CO2
II	7	Measure the traffic volume in non peak hours to analyze traffic composition at Intersection.	2#	CO2
II	8	Prepare a report of trip generation and trip attraction between two zones on the basis of origin-destination study within area of your town/city.	2	CO2
II	9	Measure the spot speed on corridor of road way to analyze the percentile speed graphically.	2#	CO2
III	10	Prepare a report of a field visit to any major road intersection in your locality to identify the type, working of traffic signals along with your recommendations if any.	2#	CO3
III	11	Prepare a report of a field visit to any minor road intersection in your locality to identify the type, working of traffic signals along with your recommendations if any.	2	CO3
III	12	Suggest the relevant vehicle parking system for your campus along with your recommendations if any in the form of a report.	2#	CO3
III	13	Prepare a report of a field visit to any urban road way to identify the road signs and corresponding markings on road.	2	CO3

III	14	Prepare a report of a field visit to any urban road to identify the traffic island along with its sketch.	2#	CO3
IV	15	Prepare a report of a field visit to any road intersection in your locality to identify its type along with its sketch.	2#	CO4
IV	16	Identify the existing street lighting system of any two types of roads	2#	CO4
IV	17	Locate the points of conflicts in the diagram of a busy intersection on a major urban road in your locality.	2	CO4
V	18	Identify the existing type of trees to suggest any relevant maintenance required.	2#	CO5
VI	19	Draw the collision diagram for any case study of road accident.	2#	CO6
VI	20	Prepare the report on the causes of accidents and preventive measures suggested by you for the situation in practical no 18.	2	CO6
VI	21	Prepare the report on IoT powered traffic management system	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a model of traffic controlling devices.
2. Prepare posters showing traffic safety and awareness.
3. Perform traffic survey of busy road junction of city in groups and to suggest measures for improvement.
4. Prepare a report on advanced road marking machinery and materials.
5. Undertake the process of planting, protecting and maintaining the trees along the road.
6. Prepare the poster showing different types of road signs.
7. Prepare posters creating awareness about road side plantation.
8. Prepare posters creating awareness about road traffic problems and there solutions.
9. Prepare a report on advanced road Traffic control devices.
10. Prepare a report on smart traffic signals.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Fundamentals of Traffic Engineering.	3	C	2	4	0	6
			O	0	4	0	4
2	Traffic Studies	8	C	2	4	6	12
			O	2	4	0	6
3	Road Markings and Traffic Signs	8	C	2	4	6	12
			O	0	0	6	6
4	Traffic Signals and Traffic Islands.	12	C	4	4	10	18
			O	4	0	6	10
5	Road Environment and Arboriculture	6	C	2	4	4	10
			O	2	4	0	6
6	Road Accident Studies	8	C	2	4	6	12
			O	00	4	4	8
Total		45	C	14	24	32	70
			O	8	16	16	40

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	5R2	6R2	2R2	5R2	5	7
2	1U4	2U4	3U4	1U4	2U4			3	5
3	3U4	4R4	4U4	4R4	5U4			3	5
4	4A4	5U4	6U4	6U4	6A4			3	5
5	2A6	3A6	3A6					2	3
6	4A6	6A6	4A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	5
2	Observation and recording	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Topic	5
2	Active participation	5
3	Interpretation of observation	5
4	Report submission	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	-	3	3	3	3	-
CO2	3	3	-	-	3	3	3	3	-
CO3	3	3	-	-	3	3	3	3	-
CO4	3	3	-	-	3	3	3	3	-
CO5	3	3	-	-	3	3	3	3	-
CO6	3	3	-	-	3	3	3	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Transportation Engineering	Arora, N. L. Khanna Publishers, Delhi, 1996,	10: 81-7319-0933,
2	Traffic Engineering and Transport Planning	Kadiyali, L.R. Khanna Publishers, Delhi, 2001,	10:8185240779
3	Transportation Engineering Vol. I & II	Vazirani, V. N. Chaondola, S. P Khanna Publishers, Delhi, 2016	13:9780128038185;
4	Traffic Planning And design	Saxsena, S. C. Dhanpat Rai and Sons Delhi, 2016	10:8123915500
5	Highway Engineering	S. K. Khanna and C. E. G. Justo Nem Chand & Bros.	13: 978-8185240930

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XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

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2	Dr. S. J. Nikam	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
3	Er. G. B. Takey	Executive Engineer Vigilance and Quality Control	P.W.D. Nagpur
4	Dr. Abhay Shende	Member Secretory Board of Studies	J. L. Priyadashani College Of Engineering, Nagpur
5	Dr. V. G. Kondekar	HOD, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Secretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	SEC
Course Code	:	CE252H
Course Title	:	Advanced Surverying

I Rationale:

The technology has brought the significant advancements in field of surveying. This will help civil engineers for accurate measurements of physical features of various construction projects and land with utmost accuracy, speed and easy operation of these surveying equipment's. The data obtained by various advanced surveying equipment's includes information of topography, grading, elevation, distances etc. Such data obtained helps civil engineers for future project planning and effective execution . This course will help students to acquire skills associated with surveying of land and buildings.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use modern Surveying instruments for Surveying and mapping**.**

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Determine** and reduced levels of ground by tacheometer

CO2: **Use** Modern Equipement & Total Station to carryout surveying

CO3: **Use** aerial Surveying to carryout surveying

CO4: **Use** remote sensing and GIS for surveying

CO5: **Use** Drone & drone data processing tools for surveying

CO6: **Use** LiDAR technology for surveying

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
4	-	4	-	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	50	20	50+	20	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Tacheometric Surveying	1a	Identify the given componets of techeometer.	1.1	Principle of tacheometry. Use of Tacheometry and Tacheometer and its component parts, Anallatic lens	CO1
	1b	Use tacheometer for finding horizontal and vertical distances.	1.2	Tacheometric formula for horizontal distance with telescope horizontal and staff vertical	
	1c	Determine RLs of a station and the distance between the station using Tacheometric survey.	1.3	Field method for determining constants of tacheometer and Determining horizontal and vertical distances with tachometer by fixed hair method and staff held vertical, determine Elevations & Limitations of tacheometry	
and Total Station	2a	Use EDM to measure the horizantal distance between two given station.	2.1	Electronic Distance Meter(EDM) :Principle of Electronic Distance Meter (EDM),Components parts and their functions,Use of EDM	
	2b	Use EDT to measure the Horizantal angle.	2.2	Electronic Digital Theodolite :Construction and functions of Electronic Digital Theodolite.	

UNIT II: Modern Equipments	2c	Set up the Total Station on ground.	2.3	Total Station:Components Parts with their functions and Use of Total Station, Temporary adjustments, sources of errors in Total Station.	CO2
	2d	Use total station to measure horizontal and vertical angles between the given	2.4	Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station.	
	2e	Draw construction layout of the given plan using Total Station	2.5	Traversing, Profile Survey and Contouring with Total Station.Construction layout using Total Station	
UNIT III: Aerial Surveying	3a	Apply aerial surveying method for mapping.	3.1	Aerial surveying: Definition, principle, uses. Methods of aerial surveying using drones, helicopters and planes. Rules and Regulations of DGCA and Drone license.	CO3
	3b	Apply aerial surveying for inspecting civil infrastructure.	3.2	Types of Photographs, Terminology in aerial surveying. Applications of Arial Surveying in civil engineering.	
UNIT IV: Remote Sensing And GIS	4a	Use the Remote Sensing to solve the given civil engineering problem	4.1	Remote Sensing - Overview, Electro-Magnetic Energy, Remote sensing system-Active and Passive system. Applications of remote sensing in Mining, land use / Land cover, mapping. Applications of remote sensing in disaster management and Environment.	CO4
	4b	Use GIS for surveying and mapping.	4.2	GIS:Defination, Key components, functions. Application of GIS in surveying and mapping:Survey Data Integration, Topographic Mapping, Boundary Surveys, Infrastructure Development.	

UNIT V: Drone Surveying and Drone data Processing	5a	Use drone Surveying method in civil Engineering.	5.1	Drone surveyig- define, use. Cameras and Sensors: Despending on the survey requirements, drones may carry different types camera-RGB, infrared & multispectral and Sensors-LiDAR and Thermal these tools capture the data needed to create detaiiled maps and models.	CO5
	5b	Use the Flight planning software to survey the area.	5.2	Flight Planning Software: Before the survey, a flight plan is created using drone flight path, altitude to ensure comprehensive coverage of survey area.	
	5c	Use the different software to create the maps of contuorlines.	5.3	Data Processing Software: After data collection, the capture images and data are processed using software likePix4D, Agisoft Metashapes or dronrDeploy to create the maps and contourlines.	
	5d	Apply the Drone Surveying to solve the civil engineering problems.	5.4	Applications of Drone Surveying, Topographic Mapping, Agriculture, Infrastructure Inspection, Environmental monitoring.	
UNIT VI: LiDAR Technology	6a	Apply LiDAR to solve in Civil Engineering problem	6.1	LiDAR- Defination and use. Component of LiDAR-: Laser,scanner,GPS/IMU and Receiver. Application of LiDAR in civil Engineering: Topographic Mapping, Autonomous Vehicles, Archaeology , Forestry and Urban planning.	CO6

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Determine the Tacheometric Constant.	2	CO1
I	2	Determine horizontal distances by Tacheometric Method	2#	CO1
I	3	Determine reduced levels by Tacheometric Method	2#	CO1
II	4	Determine horizontal and vertical distance by using EDM	2#	CO2
II	5	Determine Horizontal and vertical angles using Electronic Digital Theodolite	2	CO2
II	6	Set the Total Station instrument on site for surveying traverse.	2#	CO2
II	7	Determine horizontal, vertical and slope distances Using Total Station	2#	CO2
II	8	Determine slope distances Using Total Station	2	CO2
II	9	Determine horizontal angles using Total Station.	2#	CO2
II	10	Determine vertical angles using Total Station.	2#	CO2
II	11	Determine the Reduce Levels of Five stations using Total Station	2#	CO2
II	12	Carry out 5-Sided closed traverse Surveying project by using Total Station. (Project)-Part1	2#	CO2
II	13	Carry out 5-Sided closed traverse Surveying project by using Total Station. (Project)-Part2	2	CO2
II	14	Carry out 5-Sided closed traverse Surveying project by using Total Station. (Project)-part3	2#	CO2
II	15	Prepare Building layout by using Total Station (Project)-Part-1	2	CO2
II	16	Prepare Building layout by using Total Station (Project)-Part-2	2#	CO2
II	17	Prepare Building layout by using Total Station (Project)-Part-3	2#	CO2
III	18	Determine the Reduce Levels of ten stations using aerial survey	2#	CO3
III	19	Prepare Building layout by using Aerial Surveying	2#	CO3
III	20	Prepare contouring map using given data of Arial Surveying images	2	CO3
III	21	Locate the coordinates of a station with the help of arial surveying	2#	CO3
III	22	Prepare Road Profile surveying map using given data of arial surveying images	2#	CO3
IV	23	Locate the coordinates of a station with the help of GPS	2#	CO4

IV	24	Locate the coordinates of a five sided Traverse with the help of Remote Sensing	2#	CO4
V	25	Prepare contouring map using given data of Photogrammetry images(Part-I) using drone surveying.	2#	CO5
V	26	Prepare contouring map using given data of Photogrammetry images(ParIIi)using drone surveying	2#	CO5
V	27	Prepare Road Profile surveying map using given data of Photogrammetry images(Part-I)using drone surveying	2#	CO5
V	28	Prepare Road Profile surveying map using given data of Photogrammetry images(Part-II) using drone surveying	2#	CO5
VI	29	Prepare Road Profile surveying map using given data of Photogrammetry images(Part-II) using LiDAR Technology	2#	CO6
VI	30	Prepare conturmap of the uneven terrain using LiDAR Technology	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:Nil

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Tacheometric Surveying	6					
2	Modern Equipments and Total Station	12					
3	Aerial Surveying	10					
4	Remote Sensing And GIS	8					
5	Drone Surveying and Drone data Processing	12					
6	LiDAR Technology	12					
Total		60					

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA): Nil

-----NA-----

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing figure of traverse	10
2	Calculation area of traverse	10
3	Performence	20
4	Results	10
	TOTAL	50

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-
CO3	3	3	-	3	-	-	2	2	-
CO4	-	-	-	3	-	-	2	2	-
CO5	3	3	-	3	-	-	2	2	-
CO6	3	3	-	3	-	-	2	2	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Advanced Surveying Total Station GPS ,GIS And Remote Sensing	Gopi Satheesh and R Sathi kumar PEARSON INDIA	------
2	Surveying and Levelling	Basak, N. N.McGraw Hill Education, New Delhi	10:3290-153-8
3	Survey I & II	S. K. Duggal,McGraw Hill Education, New Delhi	13: 978-00-701- 5137-6
4	Surveying I & II	Punmia, B.C, Ashok Kumar Jain, Arun Kumar,Laxmi Publications., New Delhi.	13: 8- 17-008853-4
5	Surveying and Levelling, Volume 1 & II	Bhavikatti, S. S.,I. K. International, New Delhi	13: 978- 81-906-9420-9

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2. https://www.youtube.com/watch?v=ZSuOeUGZE-4 accessed on 16th August 2024
3. https://www.youtube.com/watch?v=7UhaCqea7IY accessed on 16 thAugust 2024
4. https://nptel.ac.in/courses/105104100 accessed on 16th August 2024
5. https://www.youtube.com/watch?v=bbs5AEPstl4 accessed on 17th August 2024
6. https://www.youtube.com/watch?v=_vBYBN8mhfA&list=PL3MO67N_H2XxL_jS8K-gyg_Yo8lWITwQQd&index=7 accssed on 17 August 2024
7. https://archive.nptel.ac.in/courses/105/103/105103193 accessed on 17th August 2024
8. https://archive.nptel.ac.in/courses/105/104/105104101/ accessed on 17th August 2024

XVI List of Major Equipment/Machineries with Specification:

1. Twenty Second Transit theodolite with accessories
2. Electronic Digital Theodolite with accessories.
3. Electronic Distansometer with accessories
4. Total Station (+ or - 2mm accuracy) instrument with accessories
5. GPS instrument

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. W. Pawde	HOD,Civil Engineering	Government Polytechnic, Nagpur
2	Dr D.N. Kongre	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mr. N.U.Sulbhewar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er.G. B. Takey	EE. Vigilance & Quality Control	Public Works Department,Nagpur
5	Dr.Abhay Shende	Principal	JL Priyadarshni College,Nagpur
6	Dr.V.G. Kondekar	Head, civil Engineering	Government Polytechnic,Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CO/IT/AE/MT/ PK/TX/TR/AI/MK
Course Category	:	VEC
Course Code	:	VE251H
Course Title	:	Environmental Sustainability

I Rationale:

This course aims to equip students with practical skills and knowledge necessary for promoting environmental sustainability in engineering practices. The focus will be on hands-on activities, real-world applications, and practical projects that address key areas of environmental sustainability.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Address environmental concerns and provide sustainable solutions.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** and plant native and drought-resistant tree species to enhance local biodiversity.

CO2: **Manage** different types of waste, and create effective collection and processing plans for recyclable materials.

CO3: **Analyse** environmental data such as temperature and CO2 levels, and present findings through graphs and reports.

CO4: **Implement** systems for rainwater harvesting, waste water minimization, and conduct audits.

CO5: **Develop** analytical and problem-solving skills to assess environmental practices and recommend improvements for sustainability.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	2	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	25	10

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
	1	Select and plant native and drought-resistant tree species to provide shade and cool the environment through evapotranspiration.	2#	CO1
	2	Prepare seed bomb and plant it in campus.	2#	CO1
	3	Develop a schedule and assign teams to take care of the planted trees.	2#	CO1
	4	Identify and document different species of flora and fauna.	2	CO1
	5	Categorize and quantify different types of waste generated in institute campus.	2#	CO2
	6	Create a collection and processing plan for recyclable materials.	2#	CO2
	7	Monitor the effectiveness of the segregation system and provide feedback.	2	CO2
	8	Prepare a solid waste management plan of your campus.	2#	CO2
	9	Develop composting plant for biodegradable waste of your campus.	2#	CO2
	10	Create graphs and reports on temperature and CO2 levels over time.	2	CO3
	11	Calculate the carbon footprint of the campus or individual students.	2#	CO3
	12	Design a rainwater harvesting system for any building in your campus.	2#	CO4

	13	Prepare a report on wastewater generation in any one building in your campus including comments to reduce it.	2#	CO4
	14	Conduct a simple energy audit in the classroom or home.	2#	CO5
	15	Analyse energy consumption and identify saving opportunities in any campus building / home..	2#	CO5
	16	Conduct a simple waste audit in the classroom or home.	2	CO5
	17	Analyse waste generation and identify reduction opportunities.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Organize a tree planting day on campus or in the local community.
2. Design and create useful items from waste materials, such as furniture from pallets or art from plastic bottles.
3. Create educational materials and conduct workshops on energy-saving practices.
4. Organize an awareness drive to educate peers and the community about global warming and its effects.
5. Install a small-scale rainwater harvesting system at home/campus and test its efficiency.
6. Prepare and Install bird feeders in appropriate location.
7. Organize a waste material collection drive in campus or in the local community.
8. Organize a energy conservation drive in campus or in the local community.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Prepare SWM Plan / Audit / Graph	5
2	Performance / Observation	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Problem statement given to students	5
2	Performance / Observation	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	3	2	3	-	-
CO2	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	3	2	3	-	-
CO5	-	-	-	-	3	2	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A text book of Environmental Science.	Arvind Kumar	978-8176485906
2	Environmental Science	Y. K. Singh	81-224-2330-2
3	A text book of Environmental Science	Shashi Chawla, Tata McGraw-Hill Publication.	
4	Environmental Studies	Erach Bharucha, UGC, New Delhi	

XV e-References:

1. https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf. Accessed on 24 may 2024.
2. https://wbchse.wb.gov.in/storage/2024/03/ENVS_FINAL.pdf. Accessed on 24 may 2024.
3. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/2015wess_ch5_en.pdf. Accessed on 24
4. https://dl1.cuni.cz/pluginfile.php/909144/mod_resource/content/1/Goodland_Environmental%20sustainability.pdf.Accessed on 25 may 2024.
5. https://egyankosh.ac.in/bitstream/123456789/85700/1/Unit-4.pdf. Accessed on 25 may 2024.
6. https://assets-global.website-files.com/5f10ce18aa01d050c26b7c5e/62bc04ffacfdfa6cab3fa9b9_Environment

XVI List of Major Equipment/Machineries with Specification:

1. Models of rain water harvesting.
2. Models / chart of biodiversity.
3. Models / charts of composting.
4. Models/ charts of carbon foot print.
5. Models / charts of environmental sustainability.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	Head, Civil Engineering	Government Polytechnic, Nagpur
2	Mr. R. M. Walke	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur
6	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

GE Courses

Sem: IV

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in ME/EE/EC/IT/MT/TX/AE/PK/CM/MK/AI
Course Category	:	GE
Course Code	:	CE292H
Course Title	:	Basic Surveying

I Rationale:

The outcomes aim to develop essential surveying skills, crucial for accurate data collection and land measurement. Identifying signs and symbols helps in understanding survey plans. Measuring line lengths with proper equipment ensures precision. Taking bearings using a Prismatic Compass is fundamental for directional accuracy. Plotting alignments with a Plane Table Survey enhances the ability to represent field data visually. Finally, conducting levelling tasks ensures elevation measurements are correctly taken for various engineering or construction applications. These skills are critical for effective surveying, contributing to precise planning, design, and implementation of infrastructure projects.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Carry out surveys of small area**.**

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the signs and symbols used in surveying.

CO2: **Measure** the length of lines using given equipment.

CO3: **Take** bearings of the lines using Prismatic Compass.

CO4: **Plot** alignments of open traverse or boundaries of close traverse using Plane table survey.

CO5: **Carry** out levelling for given task.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Surveys	1a	Classify given type of survey based on purpose and instrument used.	1.1	Definition of Survey, Objects of survey, Types of survey, Use of survey, Principles of survey, Instruments used in surveying and levelling	CO1
	1b	Identify conventional signs and symbols in the given map.	1.2	Conventional signs and symbols used in survey maps	
urements	2a	Identify given linear distance measuring instruments.	2.1	Study and use of instruments for linear measurements- Metric chain, Measuring Tapes and its types, Ranging rod, Arrow, Peg, Digital tape, Methods of linear measurements- By pacing, by speedometer, by chaining, by digital tape. DDM, ODM, EDM.	
	2b	Describe given method of ranging.	2.2	Ranging- Direct and indirect ranging and procedure, Line Ranger, Code of signals used in ranging, Concept of Leader and Follower.	

UNIT II: Linear Meas	2c	Distinguish between given chaining procedures.	2.3	Chaining Procedure on plane and sloping ground. Correction of linear measurement for incorrect length of chain/tape.	CO2
	2d	Identify the instruments used for offset.	2.4	Taking offsets, Instruments used in taking offsets – Cross staff & Optical square; Types of offsets-Long and Short offsets, Perpendicular and Oblique offsets, Degree of precision in taking offset.	
	2e	Compute area of field from given data.	2.5	Chain & Cross Staff survey-Noting on page of field book, Precautions in booking field notes, Recording the observation. Calculation of Areas from cross staff survey	
UNIT III: Chain and Compass Traversing	3a	Convert WCB to RB and vice versa to find included angle.	3.1	Technical Terms –True bearing, Magnetic bearing, and Arbitrary bearing, Whole Circle Bearing, Quadrantal Bearing /Reduced Bearing, Conversion of bearings.	CO3
	3b	Identify the given components of Prismatic compass.	3.2	Prismatic Compass – Component parts, construction and use.	
	3c	Determine included angles of traverse using given Compass survey data.	3.3	Fore bearing, Back bearing, finding Included angles from bearings and calculation of bearings from included angles.	
	3d	Select a method of plotting traverse for plotting a traverse based on given data.	3.4	Traversing – Methods of plotting a traverse and closing error, Graphical adjustment for closing error.	

UNIT IV: Levelling and Contouring	4a	Identify given components of a level and levelling staff.	4.1	Levels and Staff- Dumpy level – Components, Construction, Fundamental axes and their relationships Line of sight, Line of Collimation, Axis of bubble tube. Temporary adjustments of dumpy level. Types of levelling Staff – Ordinary, Telescopic and Folding type	CO4
	4b	Interpret given sight from the stated conditions.	4.2	Technical Terms used in levelling– Level surface, Level line, Horizontal line, Vertical line, Datum surface, Reduced level, Bench mark and its types. Foresight, Back sight, Intermediate sight, Change point, Height of collimation. Recording in Level book. Height of collimation. Recording in Level book.	
	4c	Compute reduce levels from the given data using HI and rise and fall method.	4.3	Methods of Reduction of level – Height of instrument method and Rise and Fall method. Arithmetical checks,	
	4d	Classify given type of levelling.	4.4	Classifications of levelling - Simple, Differential, Profile, Cross sectional, fly levelling, Plotting of Profile level and cross section using level data	
	4e	Interpret the given contour map.	4.5	Contouring- Tech. Terms – Contour, Contour Interval, Horizontal Equivalent., Uses of Contour Maps Characteristics of contours, Method of locating contours, Indirect method of contouring, Interpolation of contours.	

UNIT V: Plane table survey	5a	Identify given accessory of plane table and its use.	5.1	Principles of Plane Table Survey, It's Merits and Demerits, Site conditions where Plane Table Survey is used. Accessories required, Temporary adjustments of plane table: Levelling, Centering and Orientation, Use of Telescopic Alidade.	CO5
	5b	Compare the given methods of plane table surveying.	5.2	Methods of Plane Table surveying – Radiation, Intersection and Traversing.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Draw Conventional signs and symbols used in maps or plans to represent survey data.	02#	CO1
II	2	Measure distances on plane or sloping ground using given metric chains steel or metallic tape, line ranger under direct ranging conditions.	02#	CO2
II	3	Measure distances on plane or sloping ground using given metric chains steel or metallic tape, line ranger under indirect ranging conditions.	02#	CO2
II	4	Set out the perpendicular offsets using optical square or open cross staff from a given point on the chain line as well as from a given point on the side of chain line to the chain line.	02#	CO2
II	5	Find area of a given field using Chain and cross staff survey.	02#	CO2
III	6	Observe fore and back bearings of given lines using prismatic compass, Record these in field book and calculate included and excluded angles from recorded bearings.	02#	CO3
III	7	Carry out Chain and compass survey for 5 sided traverse and record the measurements and observations in the field book and Plot the traverse surveyed. (Part -I).	02#	CO4
III	8	Carry out Chain and compass survey for 5 sided traverse and record the measurements and observations in the field book and Plot the traverse surveyed. (Part -II).	02#	CO4
IV	9	Carry out differential levelling to find Reduce levels of given points using Height of Instrument method as well as by Rise and Fall method.	2#	CO4
IV	10	Carry out Profile levelling by taking spot levels at 15 m interval and plot the profile of given alignment 300 m in length.	2	CO4
IV	11	Perform contouring by direct method for a plot of 100m x 100 m and plot the contours by method of interpolation. (Part -I).	2#	CO4

IV	12	Perform contouring by direct method for a plot of 100m x 100 m and plot the contours by method of interpolation. (Part -II).	2#	CO4
V	13	Identify the given accessory of plane table and its use in plane table survey.	2	CO5
V	14	Perform plane table survey of a given area by method of radiation.	2#	CO5
V	15	Perform plane table survey of a given area by method of intersection.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Surveys	3	C	02	00	04	6
			O	0	0	0	0
2	Linear Measurements	6	C	04	02	06	12
			O	0	0	0	0
3	Chain and Compass Traversing	8	C	02	06	12	20
			O	0	0	0	0
4	Levelling and Contouring	9	C	04	08	10	22
			O	0	0	0	0
5	Plane table survey	4	C	02	04	04	10
			O	0	0	0	0
Total		30	C	14	20	36	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q 1 to Q 35	1R2	2R2	2R2	3R2	4R2	4R2	5R2	35/35
	2U2	3U2	3U2	3U3	4U2	4U2	4U2	
	4U2	5U2	5U2	1A2	1A2	2A2	2A2	
	2A2	3A2	3A2	3A2	3A2	3A2	3A2	
	4A2	4A2	4A2	4A2	4A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Identifying the required instuments	5
2	Performance	7
3	Recording the observations, Calculations and preparing Drawings	8
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	2	-	3	-	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-
CO5	3	2	-	3	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Surveying and Levelling	N. N. Basak Tata McGraw Hill Education Pvt. Ltd.	13: 978-0-07-460399-4
2	Surveying and Levelling	R. Agor. Khanna Publishers	13: 978-81-7409-235-9
3	Surveying Vol. 1	Dr. B. C. Punmia, Laxmi Publisher.	10: 81-7008-853-4
4	Surveying and Levelling	R. Subramaniam. Oxford Higher Education, Oxford Uni. Press.	10: 0198085427
5	Surveying Theory and Practice	S.S. Bhavikatti, I K International Publishing House Pvt Ltd	10: 9380578253

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XVI List of Major Equipment/Machineries with Specification:

1. Chains, Tape, Cross staff, Optical square, Line ranger.
2. Prismatic Compass.
3. Dumpy Level, Auto Level and levelling staves.
4. Plane Table and its accessories.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K.Parbat	HOD, Civil Engineering.	Government Polytechnic, Nagpur
2	Dr. A. W. Pawde	HOD, Civil Engineering.	Government Polytechnic, Nagpur
3	Dr.D. N. Kongre	Lecturer, Civil Engineering.	Government Polytechnic, Nagpur
4	Er. G. B. Takey	Retd. Superintending Engineer	P. W. D., Govt. of Maharashtra
5	Dr. Abhay Shende	Principal	J L Priyadarshani College of Engineering
6	Dr. V. Kondekar	HOD, Civil Engineering.	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Secretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in AI/AE/CE/CO/EE/EC/IT/MK/MT/PK/TX
Course Category	:	GE
Course Code	:	ME292H
Course Title	:	Workshop Technology

I Rationale:

The subject of workshop technology aims to impart knowledge and skill components in the field. It deals with different hand and machine tools essential for manufacturing simple metal components and articles.Additionally, it aims to provide a basic introduction to recent trends in modern manufacturing techniques.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Select the machine tool and process according to industrial application.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Use** Hand tools, gauging and measuring instruments for various applications.

CO2: **Select** metal forming Processes for the various manufacturing application.

CO3: **Perform** the metal joining operations.

CO4: **Perform** the different metal cutting operations.

CO5: **Use** advance machining procesess like CNC machine, Robot and Adaptive manufacturing.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Safety practices in Basic operations and measuring Instruments	1a	Follow safety practices in basic operations.	1.1	Safety Practices, Causes of accidents, General safetyrules, Safety signs and symbols, First Aid.	CO1
	1b	Identify different hand tools for the basic operations.	1.2	Use hand tools like Suface plate, Rules,Tapes and squares, Bench Tools, Machinist's Hammers, Screw Drivers, Punches, Chisels, Scrapers, files, Pliers and Cutters, Wrenches, Hacksaw, Bench Vice, Hand Drill, Taps and die.	
	1c	Choose gauging and measuring instruments for given applications.	1.3	Demostrate proficiancy in handling Semi–Precision Tools: Calipers, Depth Gauge, Feeler gauge. Precision Tools: Micrometers,Vernier Calipers, Vernier Height Gauge, Telescopic Gauge, Hole Gauge, Bevel Protractor, Dial Indicator, Gauge Blocks and Surface plate.	

UNIT II: Basic Metal forming process	2a	Select the relevant forming process.	2.1	Types of forming process, Drop forging: Introduction to forging, upset forging, Press forging, open die and closed die forging operations.	CO2
	2b	Choose the correct comparision between various rolling and forging process on the given points.	2.2	Rolling: Principle of rolling, hot and cold rolling, Tyoes of rolling mills and Industrial applications.	
	2c	Suggest various press tool operations for given component.	2.3	Press tool:Various operations performed on press,press tool, simple,progressive and forming dies.	
	2d	Select various industrial application for forging and press shop.	2.4	Applictions of forging and press work in Automobile manufacturng and sheet metal industry.	
UNIT III: Metal joining process	3a	Select the proper welding process for the given component.	3.1	Welding Processes: Principal of welding, classification of welding processes, welding postion and techniques, welding symbols and safety measures in welding.	CO3
	3b	Select the gas welding process and its industrial application.	3.2	Gas welding: gas welding equipments, oxy-acetylene welding, types of flames, Gas cutting, industrial applications.	
	3c	Identify various resistance welding and arc welding processes.	3.3	Principal,details of types of process like spot,projection and seam welding and its industrial applications.Arc welding: arc welding equipments, flux shielded metal arc welding, TIG and MIG welding.	
	3d	Choose correct comparision of soldering and brazing process.	3.4	Soldering and brazing process, Comparison, merits, demerits and Industrial applications of processes in electronic, Electrical and Automobile industry.	

UNIT IV: Metal cutting processes and Machine tools	4a	Identify different machine tools with respect to its principal of operation.	4.1	Classification of machines with respect to principal of operation for lathe machine, drilling, shaping and Milling machines.	CO4
	4b	Select the main operations on lathe machine and drilling machine.	4.2	Types of lathe machine operations like turning, facing, taper turning, threading. Drilling operaions like Drilling, reaming, boring.	
	4c	Choose the main operations on shaper machine and milling machine.	4.3	shaper operations like slotting, groving, Milling operations like Plain milling, face milling, side milling.	
	4d	Select the tools and equipment for different machine tools.	4.4	Types of lathe and drill tools. Types of shaper and milling machine tools.	
	4e	Suggest various industrial applications for lathe, drilling and milling machine.	4.5	Applictions of lathe, drilling and milling machine in manufacturing industry.	
UNIT V: Advances in manufacturing	5a	Select advanced machining processes.	5.1	Overview of traditional machining vs. advanced machining processes. Introduction to additive manufacturing, CNC machining and Robotics.	CO5
	5b	Identify the principal of CNC machine and types of CNC.	5.2	Basic principles of CNC machine operation, including axes, coordinates, and tool paths and types of CNC.	
	5c	Select the types of Robot and suggest the applications of CNC and Robots in industry.	5.3	Fundamental concepts and principles of robotics, types of robot. Applications of CNC and Robot in various industries such as manufacturing, agriculture and Automobile.	
	5d	Identify the applications of additive manufacturing in mechanical engineering.	5.4	Principal of additive manufacturing and types. Applications of additive manufacturing in automobile industry and consumer goods.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the safetymeasures for the given any four basic operations.	2	CO1
I	2	Use Hand drill, taps and dies for the threading operation	2#	CO1
I	3	Select the gauges and measuring instrument and measure the dimensions	2	CO1
II	4	Prepare bill of material for given press work job (individually)	2	CO2
II	5	Identify the various hand tools, machine tools and equipment used in Press machine shop, write specifications, details, applications and safety rules of above tools.	2#	CO2
II	6	Interpriate the drawing and plan sequence of operations for the giveny forging job	2#	CO2
II	7	Produce a bolt head/cold chisel/hook using forging oprations.Identify the various machine components, hand tools equipments and safty rules used in forging shop.	2	CO2
III	8	Perform soldering/brazing operations.	2#	CO3
III	9	Perform the metal joining process for the given job and list the tools,equipments and safety rules for the process .	2	CO3
III	10	Interpriate the given drawing and plan sequence of operations for gas welding job.	2#	CO3
III	11	Prepare any weld joint (like lap or butt joint) involving arc welding as per the given drawing (Job to be prepared by group of 2 to 4 students depending on volume of work).Operation involve: measuring and marking, cutting, welding, and finishing.	2#	CO3
IV	12	Collect information of cutting fluid and cutting tool materials used in manufacturing industry and their application	2	CO4
IV	13	Perform job with drilling, boaring reaming and counter sinking operation as per the drawing	2#	CO4
IV	14	Read and interpret job drawing and plan sequence of operations for the giveny lathe machine job.	2#	CO4

IV	15	Set and mount the tool workpiece and select the cutting parameters for machining operations.	2#	CO4
IV	16	Perform job on lathe containing the operations like face and plain turning (Group of 2 to 4 students) (Part I) Marking, cutting and facing.	2#	CO4
IV	17	Perform Turning and finishing operation on lathe (Part II) as per drawing.	2#	CO4
V	18	Identify the various components of CNC milling machine and list the tools.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Safety practices in Basic operations and measuring Instruments	4	C	02	04	04	10
			O	0	0	0	0
2	Basic Metal forming process	5	C	04	04	06	14
			O	0	0	0	0
3	Metal joining process	7	C	04	06	06	16
			O	0	0	0	0
4	Metal cutting processes and Machine tools	9	C	04	08	06	18
			O	0	0	0	0
5	Advances in manufacturing	5	C	04	04	04	12
			O	0	0	0	0
Total		30	C	18	26	26	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 1 to Q. 35	1R2	1U2	1U2	1A2	1A2	2R2	2R2	35/35
	2U2	2U2	2A2	2A2	2A2	3R2	3R2	
	3U2	3U2	3U2	3A2	3A2	3A2	4R2	
	4R2	4U2	4U2	4U2	4U2	4A2	4A2	
	4A2	5R2	5R2	5U2	5U2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Job drawing, selection of equipment , writing procedure	5
2	Performance	10
3	Job / Result	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	2	-		-	-
CO5	3	-	-	3	2	-	2	-	-
CO6	3	-	-	3	2	-	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Elements Of Workshop Technology Vol II	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy, Media Propoters & Publisher Pvt. Ltd.	13: 978-8-185-09915-6.
2	Manufacturing Technology: Foundry, Farming and Welding - Volume 1	P. N. Rao, McGraw Hill Education; Fifth Edition, 2018	13: 978-9353160500
3	Manufacturing Technology: Metal Cutting & Machine Tools - Volume 2	P. N. Rao, McGraw Hill Education; Forth Edition, 2018	13: 978-9353160524
4	Recent Advances in Materials and Manufacturing Technologies	Dr. P. Nageswara Rao and Dr. D. Venkateswarlu, Trans Tech Publications Ltd.	13: 978-3-0357-1432-6

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2. https://www.youtube.com/watch?v=2CIcvB72dmk, Accessed on 27/5/2024
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XVI List of Major Equipment/Machineries with Specification:

1. Centre lathe machine
2. Bench Drilling Machine
3. Mini forging press
4. Mini press too
5. Column and knee type milling machine along with dividing head
6. Oxyacetelyne gas welding equipment
7. CNC Lathe/Milling machine
8. 3-D Printer st up

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Prof. A. R. Umale	HOD Mechanical Engineering (Section A)	Government Polytechnic, Nagpur
2	Prof. A. A. Jagdale	HOD Mechanical Engineering (Section B)	Government Polytechnic, Nagpur
3	Prof. N. J. Burbure	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
4	Prof. V. U. Datir	Workshop Suprintendent	Government Polytechnic, Nagpur
5	Prof. G. H. Dahole	I/C HOD Mechanical Engineering	Government Polytechnic, Gondia Government
6	Prof. G. F. Potbhare	Principal	NIT polytechnic Nagpur
7	Prof. A. R. Sheiikh	Director	A R Automation, Jafar Nagar, Nagpur

(Prof. A. R. Umale)
HOD & Chairman PBOS, ME

(Dr. G. V. Gotmare)
Member Secretary PBOS, ME

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	DIPLOMA IN CE/ME/EC/CM/IT/AE/PK/MT/TX/MK/AI
Course Category	:	GE
Course Code	:	EE292H
Course Title	:	Electrical Machines

I Rationale:

The "Electrical Machines" course equips diploma engineering students from non-electrical branches with essential knowledge of basic electrical machines, fostering interdisciplinary skills. By understanding principles, operations, and applications of electrical machines such as AC/DC motors, transformers, and modern machines, students gain industry-relevant competency to effectively interact with electrical systems in diverse engineering domains. This minor diploma enhances employability, bridging knowledge gaps and enabling collaboration in multi-disciplinary projects.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of basic electrical machines.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Select** DC machine for given application.

CO2: **Select** the transformer for given application.

CO3: **Suggest** the relevant three phase induction motor (IM) for different applications.

CO4: **Use** the relevant single phase induction motors for various applications.

CO5: **Use** BLDC and Stepper motors for various applications.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: DC Machine	1a	Classify given types of machine.	1.1	Introduction to DC and AC machines, Laws related to DC and AC machines, Classification of AC machines and DC machines, Differences between AC and DC machines.	CO1
	1b	Identify the given parts and materials for DC machine.	1.2	Construction, different parts of D.C. machines and thier functions, different materials used for parts.	
	1c	Suggest the given machine for given application.	1.3	Types of dc motor, its connection diagram and application, Types of dc generator, its connection diagram and application.	
nsformers	2a	Compare given transformers on the basis of given points.	2.1	Define transformer, working principle of transformer, construction parts and their fuctions, types of transformer, comparison between shell and core type.	

UNIT II: Tra	2b	Calculate basic parameters of single phase transformer from given data.	2.2	Different material used in construction, emf equation, voltage transformation ratio, application of single phase transformer.	CO2
	2c	Suggest transformer for given application.	2.3	Three phase transformer, its connection and application.	
UNIT III: Three-phase Induction Machine	3a	Compare the given types of three phase induction motors on given points.	3.1	Construction and working of 3 phase induction motor. Working principle, production of rotating magnetic field, synchronous speed, rotor speed and slip, types of three phase induction motor and its comparison.	CO3
	3b	Select induction machine for specified application.	3.2	Torque-Slip, Torque-Speed characteristic of three phase squirrel cage induction motor and its application, Induction generator principle and applications.	
	3c	Select given type of alternator for specified application.	3.3	Three phase alternator: construction, principle, types based on rotor construction and its application.	
UNIT IV: Single-phase Induction Motor	4a	Classify given types of single phase motors.	4.1	Double field revolvong theory, principle of making these motors selfstarting. Classification of single phase motors.	CO4
	4b	Compare the given types of single phase induction motor on the basis of given points.	4.2	Capacitor start induction run motor, capacitor start capacitor run motor, permanent capacitor motor and its connection and application.	
	4c	Suggest the application of given motor.	4.3	Universal motor its connection and application.	
r Machines	5a	Suggest the application of given motor.	5.1	Brushless DC motor (BLDC): Contruction, operation and applications.	
	5b	Suggest the application of given motor.	5.2	Stepper motor: Contruction, operation, types and applications.	

UNIT V: Othe	5c	Apply the concept of rermote operation of electrical machines for specified application.	5.3	Role of IoT in monitoring and controlling electric machines, smart sensors, data acquitions and remote diagnostics in electric machines. Energy conservation in electrical machines, remote operation of electric machines.	CO5

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the different parts of DC machine.	2#	CO1
I	2	Start DC shunt motor by using three point starter and to reverse the direction of rotation of motor.	2#	CO1
II	3	Identify the different types of transformer and its construction parts.	2#	CO2
II	4	Calculate voltage ratio and current ratio of single phase transformer.	2#	CO2
II	5	Find the regulation and efficiecy of single phase transformer by direct loading.	2	CO2
III	6	Identify the different parts of squirrel cage induction motor.	2#	CO3
III	7	Connect and run three phase induction motor by using DOL or autotransformer starter and reverse direction of rotation.	2#	CO3
III	8	Control the speed of the given three phase squirrel cage using stator voltage control or frequency control method.	2#	CO3
IV	9	Identify different windings and components of single phase induction.	2#	CO4
IV	10	Start and run single phase induction motor also reverse the direction of rotation.	2#	CO4
IV	11	Perform load test on single phase induction motor.	2#	CO3
IV	12	Connect to start and reverse the direction of rotation of universal motor.	2#	CO4
V	13	Connect to start and run the stepper motor.	2	CO5
V	14	Control the speed and reverse the direction of the BLDC motor.	2#	CO5
V	15	Prepare a report on role of IoT in monitoring and control of electrical machines.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	DC Machine	6	C	02	04	06	12
			O	00	00	00	0
2	Transformers	6	C	04	04	06	14
			O	00	00	00	0
3	Three-phase Induction Machine	7	C	02	06	08	16
			O	00	00	00	0
4	Single-phase Induction Motor	6	C	04	06	06	16
			O	00	00	00	0
5	Other Machines	5	C	04	04	04	12
			O	00	00	00	0
Total		30	C	16	24	30	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 01 to Q.35	1R2	1U2	1U2	1A2	1A2	1A2	2R2	2R2	35/35
	2U2	2U2	2A2	2A2	2A2	3R2	3U2	3U2	
	3U2	3A2	3A2	3A2	3A2	4R2	4R2	4U2	
	4U2	4U2	4A2	4A2	4A2	5R2	5R2	5U2	
	5U2	5A2	5A2						

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment	5
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-
CO5	3	-	-	3	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Text Book on Laboratory Courses in Electrical Engineering	S.G.Tarnekar and P.K.Kharbanda, S.Chand & Company Ltd., Third, 1990	13: 978-8121901048
2	A Textbook of Electrical Technology Vol-I	B.L.Theraja, A.K.Theraja, S.Chand & Co Ltd., Reprint, 2006	10: 81-219-2440-5
3	Principles Of Electrical Machines	V.K Mehta, Rohit Mehta, S Chand; Reprint Edn. 2014	13: 978-8121921916

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XVI List of Major Equipment/Machineries with Specification:

1. Three phase squirrel cage induction motor.
2. DC shunt motor.
3. Single phase transformer.
4. Single phase induction motor.
5. Universal motor.
6. BLDC motor.
7. Stepper motor.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. M. C. Musale	I/c HoD, Electrical Engineering	Government Polytechnic, Nagpur
2	Dr. P. M. Daigavane	HoD, Electrical Engineering	G.H. Raisoni College of Engineering, Nagpur
3	Mrs. Divya Piparode	Sr. Engineer	Powergrid Corporation of India, Nagpur
4	Mr. M. N. Gawande	Lecturer, Electrical Engineering	Government Polytechnic, Gondia
5	Dr. G. V. Gotmare	Lecturer, Electrical Engineering	Government Polytechnic, Nagpur
6	Mr. A. P. Dasarwar	Lecturer, Electrical Engineering	Government Polytechnic, Nagpur

(Mr. M. C. Musale)
HOD & Chairman PBOS, EE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, EE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/CM/IT/PK/AIML/MT/MC/AE/TX
Course Category	:	GE
Course Code	:	EC292H
Course Title	:	Principle of Communication Engineering

I Rationale:

Electronics Communication is a field that deals with the transmission of information through electronic means. The communication plays in various aspects of modern life, ranging from personal interactions to global connectivity in business, science, and entertainment. Electronic communication technologies facilitate this connectivity by enabling real-time exchange of information via various mediums such as radio, television, telephone, and the internet.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use basic principles of electronics communication engineering for communication system.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Set** up a communication link between transmitter & receiver.

CO2: **Use** a digital modulation technique for a digital communication system.

CO3: **Measure** the performance of a communication system for a given application.

CO4: **Identify** components in a communication system model and test the functions.

CO5: **Determine** an antenna type from the radiation pattern.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Fundamentals of Communication	1a	Appy a given type of communication link between transmitter & receiver.	1.1	Introduction to basic electronic communication system. Block Schematic and elements of communication systems. Types of electronics communication: Simplex, half duplex & full duplex. Signals: Analog & Digital signals. Applications of communication system in many different areas. Simplex, half duplex & full duplex. Signals: Analog & Digital signals. Applications of communication system in many different areas	CO1
	1b	Identify the frequency range for given aplication in electromagnetic spectrum.	1.2	Electromagnetic spectrum-different bands & their corresponding frequencies and applications.	
	1c	Justify the need of modulation in a given communication system.	1.3	Definition of modulation, Necessity of Modulation, Types of modulation: AM-Amplitude modulation, FM-Frequency modulation, PM-Phase modulation (Only definition & waveforms).	

	1d	Compare given types of Noises on a given points.	1.4	Definition of Noise, Origin of Noise, Types of Noise.	
	1e	Analyse the different sections of transmitter & receiver.	1.5	Transmitters & Receivers: Low level & high level AM transmitters, TRF & Super heterodyne receivers.	
UNIT II: Digital Communication	2a	Use a given digital modulation technique for a given digital communication system.	2.1	Elements of Digital Communication system with its block diagram: source, transmitter, channel, receiver. Advantages & disadvantages of digital communication.	CO2
	2b	Compare Analog and Digital Communication on a given points.	2.2	Communication channel, characteristics: bit rate, baud rate. Comparison between Analog and Digital Communication. Sampling theorem, Nyquist rate.	
	2c	Identify the given blocks in digital modulation techniques	2.3	Basic Digital Modulation Techniques:-Amplitude Shift Keying(ASK), Frequency shift keying(FSK) ,Binary Phase shift ,keying(BPSK). (Only definition & waveforms)	
[: Basic communication systems.	3a	Evaluate the performance of a given communication system for a given application.	3.1	Microwave & waveguide components used: Microwave frequency spectrum and band designation, Rectangular and circular waveguides and their applications. Waveguide Components-H- Plane Tee, E-Plane Tee, E-H Plane Tee. (construction & their Properties only).	
	3b	Identify a given type of radar system for a given application.	3.2	Radar system & its types:Basic Principles of Radar, Basic Radar system, Pulsed radar systems & CW Doppler radar, Radar antenna scanning methods-Horizontal nodding, Helical, Spiral. Advantages, disadvantages & applications of radar systems.	CO3

UNIT III	3c	Compare a given types of optical fibers on a given points.	3.3	Optical Fiber communication: Block diagram of optical Communication, Advantages,disadvantages & applications of optical fiber communication. Basics of Optical fiber structure, Types of optical fibers.	
UNIT IV: Advanced Communication systems	4a	Identify a given components in a given communication system model and test the functions.	4.1	Satellite communication: Introduction of satellites communication, General structure of a satellite communication system.Advantages of satellite communication, Satellite orbital terms: Apogee, Perigee, Major axis, Minor axis, Angle of inclination , Ascending Node, Descending node , Line of nodes, Prograde orbit, Retrograde orbit.	CO4
	4b	Identify the given link model for a given satellite communication system.	4.2	Satellite system link model: Satellite uplink model, Satellite transponder, Satellite downlink model, Inter-satellite link.	
	4c	Choose a given type of Cellular system for given applications.	4.3	Mobile communication: Introduction to wireless communications. A basic Cellular System, Operation of Cellular system, Terms in Wireless communication system: base Station, Control Channel, forward channel, reverse channel, Mobile Station, Mobile Switching centre.	
	4d	Classify the given types of GSM Channel types.	4.4	GSM- Digital Cellular Mobile Standard: Global System for mobile (GSM):-Services and Features, GSM System Architecture, Radio subsystem, GSM channel types.	

UNIT V: Antenna & wave propagation	5a	Compare resonant & non-resonant antenna on a given points.	5.1	Definition of antenna, types of antennas; resonant & non-resonant antenna. Definitions of: Directive gain directivity, Power gain, Antenna resistance, Antenna efficiency, Band width, Beam width.	CO5
	5b	Select the antenna type from the given radiation pattern.	5.2	Directional high frequency antenna: Folded dipole antenna, Yagi-uda antenna; construction & radiation pattern.	
	5c	Predict the process of propagation of wave.	5.3	Propagation of waves, Ground waves, Sky waves, Space waves, Tropospheric propagation.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Set up a simplex and half duplex communication link between transmitter & receiver.	2#	CO1
I	2	Generate amplitude modulated (AM) waveforms for various value of modulating voltages (undermodulation, perfect modulation & over modulation).	2#	CO1
I	3	Generate frequency modulated (FM) waveform for various values of amplitude & frequency of modulating signals.	2#	CO1
II	4	Test the sample and hold circuit for various sampling frequencies to check the sampling theorem.	2#	CO2
II	5	Test the performance of ASK/FSK/PSK modulator and demodulator.	2#	CO2
III	6	Measure the output power in different arms of E-plane Tee / H-plane Tee / magic Tee.	2	CO3
III	7	Set the model of MTI radar for demonstration and observe the detection of object in range.	2	CO3
III	8	Use optical fiber as a communication channel to transmit an analog signal.	2#	CO3
III	9	Use optical fiber as a communication channel to transmit a digital signal.	2#	CO3
IV	10	Identify the various components in satellite communication model and test the functions.	2#	CO4
IV	11	Connect the satellite system model to set direct communication link and observed the communication established to transfer audio signal.	2#	CO4
IV	12	Identify different sections and components of mobile phone such as ringer section , dialer section, receiver section, transmitter section, camera, microphone, speaker , flashlight.	2#	CO4
IV	13	Use the CRO to observe the audio signal in mobile system using mobile kit.	2	CO4
V	14	Determine the radiation pattern of the given Yagi-Uda antenna.	2#	CO5
V	15	Determine the radiation pattern of the given dipole antenna.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Fundamentals of Communication	6	C	04	06	04	14
			O	0	0	0	0
2	Digital Communication	5	C	02	06	04	12
			O	0	0	0	0
3	Basic communication systems.	7	C	02	08	06	16
			O	0	0	0	0
4	Advanced Communication systems	7	C	02	08	06	16
			O	0	0	0	0
5	Antenna & wave propagation	5	C	04	06	02	12
			O	0	0	0	0
Total		30	C	14	34	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 1 to Q. 35	1R2	1R2	1U2	1U2	1U2	1A2	1A2	35/35
	2R2	2U2	2U2	2U2	2A2	2A2	3R2	
	3U2	3U2	3U2	3U2	3A2	3A2	3A2	
	4R2	4U2	4U2	4U2	4U2	4A2	4A2	
	4A2	5R2	5R2	5U2	5U2	5U2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing circuit diagram, selection of equipment,Writing observation table, etc	5
2	Performance of the practical	10
3	Taking observations, Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	1	-	-		-
CO2	3	-	-	-	1	-	-	-	-
CO3	3	-	2	2	-	2	2	-	-
CO4	3	-	2	2	-	2	2	-	-
CO5	3	-	2	2	-	2	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Electronic Communication System.	George Kennedy McGraw-Hill, 5th Edition,2011.	13: 978-0071077828
2	Principles of Communication Engineering.	Anokh Singh S.Chand & Co ltd,5th Edition, New Delhi-1999	13: 978-812190476
3	Digital Communication	John Proakis and Masoud Salehi, McGraw-Hill Higher Education, Fifth Edition, 2007	13: 978-0072957167
4	Electronic Communication systems	Kennedy, Davis, Tata McGraw-Hill,FourthEdition,2000	10: 0-07-463682-0
5	Satellite Communication	D.C. Agarwal, Khanna publishers, Fifth Edition, 2009	10: 81-7409-144-0
6	Wireless Communication	Theodore S. Rappaport, Prentice Hall Of india, 5th Edition 2011	13: 9788131731864
7	Antenna Theory: Analysis and Design	Constantine A. Balanis Wiley-Student, New Delhi, India,4th Edition,2015.	13: 978-1118642061

XV e-References:

1. http://www.pa2old.nl/files/am_fundamentals.pdf,accessed on 30th May2024.
2. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-ec11/ ,accessed on 2nd May 2024.
3. https://www.youtube.com/watch?v=xltpukBncs8 accessed on 11th March 2024
4. http://www.nptelvideos.in/2012/12/digital-communication.html accessed on 2nd March 2024.
5. http://nptel.ac.in/courses/117104127 , accessed on 20th May,2024.
6. https://www.youtube.com/watch?v=exxj8S-tPgs accessed on 27th June, 2024.

XVI List of Major Equipment/Machineries with Specification:

1. Ammeter MI 0-5-10
2. Voltmeter MI 0-150-300 V
3. CRO (Cathode Ray Oscilloscope)
4. Digital Multimeter
5. Connecting wires
6. Trainer kits

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R.V.Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur
2	Dr. V.H.Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur
3	Dr. D. N. Bhange	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur
4	Mrs.U.M. Ramteke	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur
5	Mr.Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur.

(Dr. R. V. Yenkar)
HOD & Chairman PBOS, EC

(Dr. G. V. Gotmare)
Member Sectretary PBOS, EC

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COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/AE/TX/PK//MT/MK
Course Category	:	GE
Course Code	:	IT292H
Course Title	:	Web Designing

I Rationale:

Web Page Design is used to develop online applications for various organizations such as organizational and educational websites, virtual learning environments, business applications in various fields such as products, sales, banking railways reservation, services etc. Web pages are categorized into two namely: static and dynamic web page. This course introduces web page design using HTML5 and also give emphasis on learning Cascading Style Sheets (CSS) which is a style sheet language used for describing the presentation of a document written in a markup language for formatting and styling of content.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Develop and maintain websites and web applications

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Design** the web page using basic tags of HTML.

CO2: **Develop** web page using list and hyperlinks.

CO3: **Develop** web pages using images, colors and backgrounds.

CO4: **Design** HTML forms using table and frames.

CO5: **Create** a Webpage using Cascading Stylesheets.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to HTML	1a	Select correct defination from given statement.	1.1	Introduction of HTML	CO1
	1b	Identify structure of the given HTML page	1.2	Terminologies used in Web Design: World Wide Web (www), Web Pages, Web Site, Web Browsers, Web Servers and types of sites. Static vs. dynamic web sites, Search Engine.	
	1c	Identify use of attributes in given HTML tag.	1.3	Web page structure: DOCTYPE, HTML, TITLE, HEAD, BODY and other meta tags with attributes.	
	1d	Compare block level and text level tags on given points.	1.4	Block Level Elements: Headings, Paragraphs, Breaks, Divisions, Centered Text, Block Quotes, Preformatted text, types of Address, HR tag. Horizontal RuLe.	
	1e	Select the procedure of using the given Text level tag and use of special characters in web page.	1.5	Text Level Elements: Bold, Italic, Teletype, Underline, Strikethrough, Superscript, Subscript, DIV tag, displaying special characters, comments.	

UNIT II: Lists and Links	2a	Compare different types of given list.	2.1	Lists: Ordered Lists, Unordered Lists, Definition Lists, Nested Lists.	CO2
	2b	Compare different types of given Links.	2.2	Links: Absolute, Relative and Inline links, use image as link, link to an email address, button as link, types of links, linking various documents for internal and external links, to link different web page of same site, link different location on the same web page, a specific location on different web page of same site, to specific section within the document, inserting E-mail link.	
UNIT III: Images, Colors and Background	3a	Compare different types of image formats on basics of given point.	3.1	Image: Types of image format, jpg, bmp, png gif etc. IMG tag, alternate text, image alignment, HSPACE, VSPACE, height and width of images.	CO3
	3b	Identify given types of attributes of body tag.	3.2	Colors and Backgrounds: The text color, color attribute of FONT tag, text attribute of BODY tag. bgcolor attribute of BODY tag, Backgrounds: Inserting image as page background, background attributes of BODY tag.	
UNIT IV: Table, Frames and Forms	4a	Select appropriate tag on given table with attributes to organize data on a web page and table setting.	4.1	Table: Table tag with attributes. TABLE, <tr>, <th>, <td> tags. Border, cell spacing, cell padding, width, align, bgcolor attributes. Adding captions: CAPTION tag	CO4
	4b	Identify given types of table attributes.	4.2	Formatting contents in the table cells: align, valign, bgcolor, height, width. Spanning rows and columns: rowspan and colspan attributes.	
	4c	Identify the given type of 'frame' with examples and procedure to organize display as per given screen layout using frames.	4.3	Frames: Types of Frames with their attributes, Creating frames: FRAMESET tag – rows, cols attributes, FRAME tag – name, frame border, margin height, margin width, src.	

	4d	Identify the given attribute/elements of form tag	4.4	Forms: Creating basic form: FORM tag, action and method attributes, Form fields: Single line text field, password field, multiple line text area, radio buttons, and check boxes.	
UNIT V: Cascading Style sheets	5a	Identify CSS code for the given type of formatting on a web page with different CSS properties.	5.1	Cascading Style Sheets: Different types of Style Sheets, Benefits of using CSS. Adding style to the document: Linking to style sheets, Embedding style sheets.	CO5
	5b	Select the procedure to create CSS for applying the given presentation scheme on a web page.	5.2	Style sheet properties: Font, text, box, color and background properties; Creating and Using a simple external CSS file; Using the internal and inline CSS; background and color gradients in CSS Setting font and text in style sheet using table layout.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Design a Web page using basic HTML tags -<HTML>, <HEAD>, <TITLE>, <BODY>.	2#	CO1
I	2	Create a web page which display a string "Welcome to GP nagpuri" in all < h1> to <h6> header tags.	2#	CO1
I	3	Create a web page for displaying a paragraph using block level tags, HR tags.	2#	CO1
I	4	Create a web page using text level tags.	2#	CO1
II	5	Design a web page for implementing ordered list and unordered list.	2#	CO2
II	6	Design a web page for implementing: Ordered list within unordered list,Unordered list within ordered list, Ordered list within ordered list,Unordered list within unordered list.	2#	CO2
II	7	Create a web page to link: A different web page of same site,A different location on the same web page, A Specific location on different web page of same site.	2#	CO2
II	8	Create web page to link: An external page of different web site,To an e-mail ID.	2#	CO2
III	9	Create a webpage which includes photos and align with the ALT property on the left, right, and center.Create a webpage to set picture in left, right, and middle alignment.	2#	CO3
III	10	Insert images on web page using various attributes and set image as background.	2#	CO3
III	11	Create a web page to implement Table.	2#	CO3
III	12	Create table within table and also insert an image within the data elements of the table.	2#	CO3
IV	13	Create a web page to implement frame tags.	2	CO4
IV	14	Create a webpage using form with all its elements.	2#	CO4
V	15	Develope a program to create a web page to demonstrate CSS using internal and external CSS.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to HTML	6	C	02	04	00	6
			O	00	00	00	0
2	Lists and Links	6	C	02	06	00	8
			O	00	00	00	0
3	Images, Colors and Background	6	C	02	06	08	16
			O	00	00	00	0
4	Table, Frames and Forms	6	C	06	10	08	24
			O	00	00	00	0
5	Cascading Style sheets	6	C	04	06	06	16
			O	00	00	00	0
Total		30	C	16	32	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q. 1 to Q. 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35	
	3R2	3U2	3U2	3U2	3A2	3A2	3A2		
	3A2	4R2	4R2	4R2	4U2	4U2	4U2		
	4U2	4U2	4A2	4A2	4A2	4A2	5R2		
	5R2	5U2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Activities/ Writing program	5
2	Performance/Execution of program	10
3	Viva Voce	10
4		
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	-	3	-	3	-	-
CO2	3	3	-	-	3	-	3	-	-
CO3	3	3	-	-	3	-	3	-	-
CO4	3	3	-	-	3	-	3	-	-
CO5	3	-	-	-	3	-	3	-	-
CO6	3	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Teach yourself HTML & CSS in 24 hours	Julie C. Meloni, 9th Edition	13: 9789332535992
2	HTML & CSS: The Complete Reference	Thomas A. Powell, 5th Edition	13: 9780070701946
3	HTML & CSS: Design and Build Web Sites	Jon Duckett	13: 9781118206911

XV e-References:

1. https://edu.gcfglobal.org/en/basic-html/links-and-images-in-html/1/ accessed on 5th aug 2024
2. https://www.w3schools.com/html/ , accessed on 5 aug 2024
3. https://www.codecademy.com/learn/learn-html , accessed on 18th Aug 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer (Dual CORE and above) with Internet connection.
2. Windows 7 or 8 or latest (Professional Edition/Academic edition)

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. R.Mahajan	HoD Information Technology	Government Polytechnic, Nagpur
2	Mr. Dipak Dhote	Operations manager	IT-Network Infosystem Pvt Ltd. Nagpur
3	Mr. Rajesh Kadu	Assistant Professor	Ramdeobaba College of Engineering Nagpur
4	Mrs. V. A. Raje	System Analyst	MSBTE, RO, Nagpur
5	Dr. S. S. Gharde	Lecturer in IT	Government Polytechnic, Nagpur

(Dr. A. R. Mahajan)
HOD & Chairman PBOS, IT

(Dr. G. V. Gotmare)
Member Secretary PBOS, IT

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GOVERNMENT POLYTECHNIC, NAGPUR
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COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/IT/CM/MK/AI/AE/TX
Course Category	:	GE
Course Code	:	MT292H
Course Title	:	Testing of Materials

I Rationale:

A "Testing of Materials" course is crucial for metallurgy diploma students in India as it provides foundational knowledge in assessing material properties essential for quality control and engineering applications. Understanding testing methods, such as tensile, hardness, and impact tests, equips students to ensure material reliability and safety in various industries. This course bridges theoretical knowledge with practical skills, enhancing their ability to address real-world challenges in metallurgy

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Conduct Metallurgical Testing and Inspection procedures

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** different parts of testing equipments

CO2: **Select** destructive and NDT methods of testing

CO3: **Recommend** suitable test for different applications.

CO4: **Prepare** sample for different tests to be carried out

CO5: **Operate** various Testing equipments

CO6: **Perform** different NDT tests

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Scope Of Testing	1a	Compare Mechanical, Physical and Chemical properties of given metals.	1.1	The scope and need of testing Mechanical, Physical and Chemical properties of metals.	CO1
	1b	Identify elastic and plastic bodies	1.2	Concepts of Stress, strain, elastic and plastic bodies strain under axial load in tension and compression	
	1c	Prepare various reports on testing	1.3	Types and Forms of various Testing Results	
	1d	Compare different Standardizing agencies	1.4	Standardizing Agencies: SAE, AISI, ASTM, BIS, IS	
II: Mechanical Testing	2a	Sketch a standard Tensile Specimen	2.1	Tensile test: Scope and applicability. Modulus of elasticity / Young's modulus	CO2
	2b	Use Hook's law to find Youngs modulus	2.2	Specification of testing specime. Effect of important variables, Hook's law	
	2c	Calculate proof stress for given material	2.3	Yield stress and proof stress determinations, calculation of true and engineering stress – strain	

UNIT	2d	Use of UTM machine for tensile test of given sample	2.4	Types of tensile testing machine & their construction: Universal testing machine, Extensometer and recorders	
UNIT III: Hardness Test	3a	Justify the need of hardness testing in industrial application	3.1	Scope and applicability of hardness test.	CO3
	3b	Use MOH'S scale to compare hardness of different minerals	3.2	Scratch and wear hardness test- moh's scale	
	3c	Identify different hardness Testers	3.3	Rockwell test: procedure, effect of variables in rockwell hardness tester	
	3d	Compare given hardness test on the basis of given following points	3.4	Vickers hardness test- Procedure, derivation of VHN, effect of variables, applications, advantages and limitations	
	3e	Determine brinell hardness values for given samples	3.5	Brinell hardness test: Procedure, derivation of BHN, effect of variables, applications, advantages and limitations	
UNIT IV: Service Tests	4a	Identify type of fractures for given material	4.1	Charpy and Izod impact tests: standard samples used, test procedure.	CO4
	4b	Compare ductile and brittle fracture on the basis of given points	4.2	Effect of variables.: Role of temperature and stress concentration factors like holes, cracks etc	
	4c	Select suitable Impact tests for given test sample to detect fracture	4.3	Fatigue test: concept of fatigue, loading condition to cause fatigue. Study of S-N Curve Scope and applicability of fatigue test Machine for fatigue test on metals, general procedure	
ventional Non-ve Testings	5a	Justify the need for NDT in metallurgy industry	5.1	Concept of non destructive testing Need of Non-destructive test, Types of non-destructive test	CO5
	5b	Select suitable NDT for proper application	5.2	Methods of Examination for defects: Visual examination, Penentrant tests, Hammer tests etc	

UNIT V: Con Destructi	5c	Suggest suitable NDT method for magnetic materias	5.3	Method based on magnetic analysis: Magnetic particle method, yoke type
	5d	Use ultrasonic testing machine on given test sample to determine crack/defects	5.4	Ultrasonic Testing: Fundamentals, Equipments, procedure and applications. Interpretation of results

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare samples for different types of testing of materials	2#	CO1
I	2	Follow safety rules in Testing Laboratory in metallurgical plant/industry	2#	CO1
I	3	Identify ductile and or brittle failure for given material observing type of fracture occured	2#	CO1
II	4	Identify various parts of Brinell hardness Tester	2#	CO2
II	5	Operate Brinell hardness tester to MeasureHardness for given materials	2#	CO2
III	6	Operate vickershardness testingmachine for given materials to find hardness values	2#	CO3
III	7	Measure Hardness by Rockwell hardness Tester for given materials	2#	CO3
IV	8	Perform Crack detection using dye penetrant test for given material	2#	CO4
IV	9	Determine Impact strength for given material by Charpy impact tester	2#	CO4
IV	10	Determine Impact strength for given material by Izod impact tester	2#	CO4
IV	11	Operate standard fatigue testing Machine to determine fatigue in given metals and draw SN curve for the same	2	CO4
V	12	Perform Scratch and wear hardness test for given materials using moh's scale	2#	CO5
V	13	Perform Crack detection using dye penetrant test for given material	2#	CO5
V	14	Conduct Magnetic Particle Crack detection test for given material	2#	CO5
V	15	Operate U.T.M to determine Tensile strength and other given parameters for given steel bars. Prepare various results obtained from test.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Scope Of Testing	4	C	02	04	06	12
			O	0	0	00	0
2	Mechanical Testing	8	C	04	08	06	18
			O	00	00	0	0
3	Hardness Test	8	C	04	08	06	18
			O	0	0	0	0
4	Service Tests	6	C	04	08	0	12
			O	0	0	0	0
5	Conventional Non-Destructive Testings	6	C	02	08	0	10
			O	0	0	0	0
6			C	00	00	00	0
			O	00	00	00	0
Total		32	C	16	36	18	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C O
Q. 1 to Q. 35	1R2	1U2	1U2	1A2	1A2	1A2	2R2	35/35
	2R2	2U2	2U2	2U2	2U2	2A6	2A6	
	2A6	3R2	3R2	3U2	3U2	3U2	3U2	
	3A6	3A6	3A6	4R2	4R2	4U2	4U2	
	4U2	4U2	5R2	5U2	5U2	5U2	5U2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	PERFORMANCE/report writing/submission	15
2	Viva Voce	10
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	3	-	3	-	-
CO2	3	3	3	3	3	-	3	-	-
CO3	3	3	2	3	3	-	3	-	
CO4	3	3	3	3	3	2	3	-	-
CO5	3	3	3	3	3	2	3	-	-
CO6	3	3	3	3	3	2	3	-	

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Testing of Materials	Prof. A.V.K. Suryanarayana. BS Publications/BSP Books , 2nd Edition, 2013	13:978-81-7800-134-0
2	The Testing of Engineering Materials	H. E. Davis, G. E. Troxell , Mcgraw Hill Publishing Company, Fourth Edition,1982	10: 81-7409-026-6
3	Mechanical Metallurgy	George Dieter, McGraw Hill Education; Third Edition, July 2017.	13: 978-1259064791

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2. https://www.youtube.com/watch?v=UsoDrzBewIc,ASSESSED ON 14 MAY 2024
3. https://www.youtube.com/watch?v=5cNWF61Tmj0&list=PLyAZSyX8Qy5AePdV6vbGP4OJQOpbga-0Q,ASSESSED ON 14 MAY 2024
4. https://www.youtube.com/watch?v=TedpFxML8wQ , ASSESSED ON 14 MAY 2024

XVI List of Major Equipment/Machineries with Specification:

1. Standard specimen of steel, MS bar, plates etc
2. UTM 60-100 tonnes capacity
3. Rockwell hardness tester, Brinell, Vickers hardness testers
4. Impact testing machines
5. Fatigue testing machine

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Shri.K.L. Meshram	HOD, Metallurgical Engineering	Government Polytechnic, Nagpur
2	Miss.V.C. Humney	Lecturer Metallurgical Engineering	Government Polytechnic, Nagpur
3	Shri.S.M.Waikar	Lecturer Metallurgical Engineering	Government Polytechnic, Durg.
4	Dr. Y.Y. Mahajan	Assistant Professor Metallurgy & Material Science	VNIT, Nagpur
5	Shri.D.P Mukherjee	Works Manager (Rtd.)	Ordnance factory Ambhajhari, Nagpur

(Mr. K. L. Meshram)
HOD & Chairman PBOS, MT

(Dr. G. V. Gotmare)
Member Sectretary PBOS, MT

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/PK/CM/AE/AI/MK
Course Category	:	GE
Course Code	:	TX292H
Course Title	:	Dyeing and Printing

I Rationale:

This course is designed for the students of other than Textile department. The Dyeing and Printing course explores the art and science of coloration and decoration in Textiles. Students learn traditional and digital techniques understanding color theory, dye chemistry and printing processes.Bymastering dyeing and printing, students enhance textile products astheticand functional value.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply dyeing and printing on textile material.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Classify** the pretreatment process.

CO2: **Identify** the type of dye used for cotton material.

CO3: **Select** dye for protein and synthetic fibre

CO4: **Use** different methods of printing.

CO5: **Develop** print by diffrent styles of printing on textiles.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Pretreatment for dyeing and Printing	1a	Identify flow chart of given wet procesing sequence.	1.1	Importance of Textile wet processing and Pretreatment Process, flowchart and objectives of each process.	CO1
	1b	Classify the given pretreatment process.	1.2	Classification of singeing machine, desizing, bleaching process. chemicals used in desizing process, scouring process,bleaching and mercerisation process.	
UNIT II: Dyeing of celllulosic fibres	2a	Classify the given type of dye for cotton material	2.1	Object of dyeing, Classification of Dyes, Common terms used in dyeing, dyeing assistants, Mechanism of dyeing. Natural Dyes and its importance	CO2
	2b	Apply the given dye on cotton/ viscose material.	2.2	Dyes for cellulosic material- Direct Dyes, Reactive dyes and Vat Dyes. Properties, types, parameters affecting dyeing quality, dyeing procedure.	

UNIT III: Dyeing of protein and synthetic fibre.	3a	Select the given dye for protein fabric.	3.1	Dyes for protein fibres, Classification of Acid dyes and basic dyes, Properties, dyeing procedure of silk and wool fibre.	CO3
	3b	Apply disperse dye to dye given fabric.	3.2	Classification of disperse dyes and cationic dyes, Properties, dyeing procedure of polyester, acetate and acrylic fibre.	
UNIT IV: Methods of printing	4a	Compare dyeing with printing on given parameters.	4.1	Objects of printing, difference between dyeing and printing, preparation of printing paste, sequence of printing. Ingredients in printing paste.	CO4
	4b	Use given printing method to print the fabric.	4.2	Methods of printing- Block, stencik, duplex, screen,transfer printing, rolle printing machiner, rotary sreen and flat bed screen printing machine.	
UNIT V: Styles of Printing	5a	Suggest different styles of given printing.	5.1	Styles of printing- Direct, discharge and resist printing.	CO5
	5b	Use dyes to print given fabric	5.2	Printing procedure of cotton and polyester.After treatment to printed goods.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Use chemicals to desize the grey fabric.	02#	CO1
I	2	Use chemicals to scour the given fabric.	02#	CO1
I	3	Use chemicals to bleach the given cotton fabric.	02#	CO1
I	4	Apply caustic treatment to mercerise the cotton fabric.	2	CO1
II	5	Use pretreated samples to dye with given natural dye.	02#	CO2
II	6	Use direct dye to dye given cellulosic material.	02#	CO2
II	7	Use reactive dye to dye given viscose/cotton material	02#	CO2
II	8	Use vat dye to dye given cotton material	02#	CO2
III	9	Use acid dye to dye protein material.	2	CO3
IV	10	Prepare printing paste for given textile material and write the functions of each ingredient.	02#	CO4
IV	11	Apply block print on given material.	02#	CO4
IV	12	Apply screen print on given material.	2	CO4
V	13	Prepare printing paste and print given fabric with direct style of printing.	02#	CO5
V	14	Apply tie and dye printing technique.	02#	CO5
V	15	Prepare printing paste and print given fabric with resist style of printing.	02#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Pretreatment for dyeing and Printing	8	C	6	8	6	20
			O	0	0	0	0
2	Dyeing of celllulosic fibres	6	C	2	6	6	12
			O	0	0	0	0
3	Dyeing of protein and synthetic fibre.	6	C	2	4	6	12
			O	0	0	0	0
4	Methods of printing	6	C	2	6	6	14
			O	0	0	0	0
5	Styles of Printing	4	C	2	4	4	10
			O	0	0	0	0
Total		30	C	14	28	28	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	-----NA-----	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	
Q .01 TO Q.35	1R2	1R2	1R2	1U2	1U2	1U2	1U2	35/35
	1A2	1A2	1A2	2R2	2U2	2U2	2U2	
	2A2	2A2	2A2	3R2	3U2	3U2	3A2	
	3A2	3A2	4R2	4U2	4U2	4U2	4A2	
	4A2	4A2	5R2	5U2	5U2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Procedure	5
2	Performane	10
3	Result	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	3	-	-
CO2	3	-	-	3	-	-	3	-	-
CO3	3	-	-	3	-	-	3	-	-
CO4	3	-	-	3		-	3	-	-
CO5	3	-	-	3		-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Chemical Processing of Textiles	NCUTE Publication	-
2	Technology of Printing Vol. IV	V.A.Shenai, Sevak Publication, 2003	13: 9783659686047
3	Dyeing and Chemical Technology of Textile Fibres	E R Trotman, John Wiley & Sons Inc; 6 Sub edition, 1985	13: 978-047180910
4	Chemical Technology in Pre-Treatment processes of Textiles	S.R.Karmakar, Elsevier Science, 1 Edition, 1999	13: 9780444500601
5	Technology of Textile Processing	V. A. Shenai, Sevak Publication, Vol X, 1987	OCLC:313590523

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2. https://www.researchgate.net/figure/Types-of-dyes-used-for-the-dyeing-of-protein-fibers_fig3_351022496,assessed on 18th September 2024
3. https://www.slideshare.net/DuraisamyRamesh1/printing-methods-styles,assessed on 18th September 2024
4. https://www.slideshare.net/DuraisamyRamesh1/printing-methods-styles, assessed on 18th September 2024

XVI List of Major Equipment/Machineries with Specification:

1. Beaker dyeing machine
2. Beaker dyeing machine
3. Induction
4. Steel utensil
5. Pipete
6. Glass beaker
7. Screen
8. Block
9. Weighing balance

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr C.P.Kapse	I/C HOD Textile Manufacture	Government Polytechnic, Nagpur
2	Dr. S.G Gaikwad	Selection Grade Lecturer Textile Manufacture	Government Polytechnic, Nagpur
3	Prof L.S.Chakraborty	Lecturer Textile Manufacture	Government Polytechnic, Nagpur
4	Dr Ganesh Kakad	HOD Textile Engineeering	JDIT, Yavatmal
5	Mr Laxminarayan Kaushik	Director	LLP Professional, Nagpur
6	Prof. Harshal Ramteke	HOD Textile Technology	Sasmira, Mumbai
7	Prof S.S.Lawand	Selection Grade Lecturer Textile Manufacture	Government Polytechnic, Nagpur

(Dr. C. P. Kapse)
HOD & Chairman PBOS, TX

(Dr. G. V. Gotmare)
Member Sectretary PBOS, TX

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/PK/AI/MT/MK/TX
Course Category	:	GE
Course Code	:	AE292H
Course Title	:	Two Wheeler Technology

I Rationale:

There is an increased need of public transport. The public transport systems in cities and in rural area do not meet the requirement effectively. This has led to huge demand of two wheelers. Presently the two wheelers are used by a large section of society as personalized transport. In view of the growth, large employment potential in this field and the manpower required to cater to the same, this subject is included as an elective subject.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the knowledge of two wheeler to maintain and Repair vehicle.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** proper frame and chassis types and material for two wheelers.

CO2: **Diagnose** various problems in two-wheeler fuel and lubrication systems.

CO3: **Perform** repairs on transmission, steering, suspension and braking system.

CO4: **Maintain** the electrical systems and lightning system of a given vehicle.

CO5: **Identify** the significance of aerodynamics, aesthetics, ergonomics, safety.

CO6: **Identify** various advance mechanism used in Two wheeler.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2		4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objectice Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Frame and chassis	1a	Classify the frames with given parameters.	1.1	Frames: Single cradle frame, Double cradle frame, Tabular frame and its types, Engine based frame and Twin spar frame.	CO1
	1b	Compare the given two wheeler chassis on the given basis.	1.2	Chassis: Conventional chassis and monocoque or integral construction. Layout of Two wheeler vehicle.	
	1c	Select relevant frame materials for given vehicle application with justification.	1.3	Frame material and its properties: Alloy steel, aluminium alloy, carbon fiber.	
nission system	2a	Compare engine technology upgradation from BS IV to BS VI.	2.1	Basics of two wheeler engine, Engine technology upgradation (From BS IV to BS VI), Engine selection criteria, Valve operating mechanism.	
	2b	Select an air filter for given vehicle with justification.	2.2	Induction System: Air filter/Air cleaner: Function, types, construction and working.	

UNIT II: Fuel supply and er	2c	Identify an engine exhaust system component for given vehicle .	2.3	Exhaust System: Function, Construction. Basic Parts- Heat Diffuser, Header pipe, Muffler.	CO2
	2d	Draw the sketch of fuel supply system and describe it.	2.4	Fuel supply system: Block diagram, Construction & working of Carburetor System, Electronic fuel injection system as per BSVI Norms.	
	2e	Justify the application of lubrication system for the given two wheeler engine.	2.5	Lubrication system: Lubrication in four stroke engines of two wheeler.	
UNIT III: Comfort and Control system	3a	Identify the transmission system of the given vehicle on the given parameters.	3.1	Transmission system : Layout of transmission system in two wheeler, Construction and working of - Cable actuated wet multi- disc clutch, Centrifugal clutch, Chain drive, Continuous variable transmission (CVT), Gearbox- working of constant mesh gearbox, Gear shifting mechanism- hand and foot operated shifting mechanism.	CO3
	3b	Find effect of steering geometry relevant parameters for the given vehicle with sketch.	3.2	Steering system: Steering geometry and effects-Caster angle & Trail, Steering fork, Handlebar arrangement.	
	3c	Select the suspension system for the given application with justification.	3.3	Suspension System: Two wheeler suspension system- Spring and damper- swing arm and telescopic type. Monoshock suspension. Swing Arm type rear suspension of passenger Auto rickshaw.	
	3d	Compare the braking system of the given vehicle on the basis of given parametes.	3.4	Braking system: Drum brake and disc brake - Construction & Working. Brake control system- hand and foot operated brake, Braking system of Auto rickshaw.	

	3e	Select wheels and tires for the given vehicle with justification.	3.5	Wheels and tires selection criteria of wheels and tires and their specification for motorcycle scooter sports bike.	
UNIT IV: Electrical system	4a	Justify the working of the given ignition system with sketch.	4.1	Ignition system: a. Working of capacitive discharge ignition system. b. Procedure to check CDI system aggregates. c. Microprocessor control ignition system block diagram and working. d. Concept of twin Spark ignition system.	CO4
	4b	Select the procedure to check aggregates of CDI system with sketch.	4.2	Starting system: a. Kick start and button start arrangement. b. Components of starting system and their function DC motor battery rating for use in button start vehicle.	
	4c	Compare the engine starting system and their aggregates on the basis of the given parameters.	4.3	Charging system components of charging system schematic circuit and working of charging system.	
	4d	Determine the specification and features of the given dashboard oblique lighting system aggregate.	4.4	Lighting system and accessories: a. Specification and application of headlamp tail and number plate lamp purpose of using LED lights in tail lamp turn signal lamp side stand indicator lamp high beam indicator lamp neutral indicator lamp speedometer lamp on mobile charger point headlamp and tail lamp reflectors used in two wheelers. b. Dash units use of speedometer analogue and digital trip meter use of engine speed indicator/tachometer.	

UNIT V: Aerodynamic and safety aspects	5a	Draw sketch of the given aggregates of aerodynamic for the vehicle.	5.1	Aerodynamic as aspects:a-Headlamp shape sealed beam and conventional Tail lamp and indicator light arrangement body in closed and separate c-Shaped of attack in motorcycle.	CO5
	5b	Justify a mix of spectral even to the given vehicle handling sitting arrangement with sketch.	5.2	Ergonomic aspect: a. Seat arrangement for raider and pillion rider. b. Handle bar position.	
	5c	Identify significance of aesthetic aspects for relevant aggregates of the given vehicle with justification.	5.3	Aesthetic aspect: a. Headlamp fairing of motorcycle. b. Side panels for scooter scooter and motorcycle. c. Ground clearance d mudguard shape and position.	
	5d	Select the safety aspect of given two wheeler relay rider and justify it.	5.4	Safety expect: a. Crash bar saree guard. b. Driving habits. c. Drive gear jacket helmet day night.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Dismantle the given two wheeler vehicle.	02#	CO1
I	2	Identify the parts of the vehicle frame and chassis.	02#	CO1
I	3	Assemble the given two wheeler vehicle.	02#	CO1
II	4	Adjust Valve Clearance of the given engine using relevant tools.	02#	CO2
II	5	Service induction system of the given two wheeler petrol engine for emission control.	02#	CO2
II	6	Fine-tune idle speed of a two wheeler engine using the specified procedure.	02#	CO2
II	7	Lubricate the given two wheeler chassis.	2	CO2
III	8	Dismantle the given clutch assembly to check condition of components with reference to service manual.	2	CO3
III	9	Adjust the multi-plate clutch after assembly.	02#	CO3
III	10	Dismantle the gearbox of the given two wheeler	02#	CO3
III	11	Assemble the gearbox of the given two wheeler	02#	CO3
III	12	Service the brake system of the given two wheeler.	02#	CO3
III	13	Maintain ignition system of the given two wheeler.	2	CO3
IV	14	Check components of self- start system of the given two- wheeler engines.	02#	CO4
IV	15	Maintain wiring harness of the given two- wheeler.	2	CO4
V	16	Adjust handlebar for ergonomic position of given two wheeler.	02#	CO5
VI	17	Interpret the aerodynamic, ergonomic design and safety aspects of the given two or three wheelers.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Frame and chassis	4	C	02	06	06	14
			O	0	0	0	0
2	Fuel supply and emission system	8	C	02	06	06	14
			O	0	0	0	0
3	Comfort and Control system	7	C	02	06	06	14
			O	0	0	0	0
4	Electrical system	7	C	02	06	06	14
			O	0	0	0	0
5	Aerodynamic and safety aspects	4	C	02	06	06	14
			O	0	0	0	0
Total		30	C	10	30	30	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 1 to Q. 35	1R2	1U2	1U2	1U2	1A2	1A2	1A2	35/35
	2R2	2U2	2U2	2U2	2A2	2A2	2A2	
	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	4R2	4U2	4U2	4U2	4A2	4A2	4A2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of equipment.	5
2	Writing procedure and Performance.	10
3	Conclusion and Result.	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	2	-	3	-	3	-	-
CO2	3	-	2	3	3	-	3	-	-
CO3	3	-	2	3	3	-	3	-	-
CO4	3	-	-	3	3	-	3	-	-
CO5	3	-	-	3	3	-	3	-	-
CO6	3	-	-	3	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Two and Three Wheeler Technology	Panchal, Dhruv, U, PHI Learning Pvt. Ltd; New Delhi, 2015	13: 9788120351431
2	Two and Three Wheeler Technology	Ramlingham K.K, Scitech Publications (India) Pvt Ltd, 2010	13: 978-0-7680-0029-0 10: 8183712037
3	Automobile Engineering Vol. I	Dr. Kripal Singh, Standard Publishers Distributors, 13th Edition, 2013	13: 97881801419669
4	Automotive Mechanics	Crouse. W.H., Anglin, McGraw Hill Education (India) Private Limited, 10th Edition, 2006	10: 0070634351
5	Vehicle Body Layout and Analysis	John Fenton, Hutchinson, London, 1986	10: 0852984456

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4. https://www.youtube.com?v=yYexaLUp610, accessed on 7, August 2024
5. https://www.youtube.com?v=mhhDiz3bwk, accessed on 7, August 2024
6. https://www.youtube.com/watch?v=Jk6V1Kdeons
7. https://www.youtube.com/watch?v=AAJyUk4wHfI&list=PLyqSpQzTE6
8. https://www.youtube.com/watch?v=NJkU8wbjgjs&list=PLyqSpQzTE6
9. https://www.youtube.com/watch?v=54GyDX_pzvw&list=PLyqSpQzTE6
10. https://www.youtube.com/watch?v=QWAhLyL2lBk

XVI List of Major Equipment/Machineries with Specification:

1. Two wheeler vehicle- frames (Single cradle frame)
2. Two wheeler vehicle- frames (Double cradle frame)
3. Universal clutch holder
4. Working model of two wheeler transmission system (4 speed transmission)
5. Working model of two wheeler transmission system (4-forward and 1-Reverse transmission)
6. Two wheeler vehicle engine (4-stroke, single cylinder engine)
7. General purpose tools (Spanners, ings spanner and socket set.)-6mmto 32mm
8. Torque wrench range -10Nm to 200Nm.
9. Allen key set - star & hex
10. Feeler gauge set

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. G. K. Awari	HOD, Autombile Engineering	Government Polytechnic, Nagpur
2	Prof. D. K. Bawane	Lecturer, Auomobile Engineering	Government Polytechnic, Nagpur
3	Dr. S. D. Thakre	Lecturer, Auomobile Engineering	Government Polytechnic, Nagpur
4	Dr. S.A. Telang	Lecturer, Auomobile Engineering	Government Polytechnic, Nagpur
5	Prof. J M Syed	Lecturer, Auomobile Engineering	Government Polytechnic, Nagpur
6	Mr. Promod Nichat	Rtd. Asst. General Manager	Ashok Layland, Chennai
7	Dr. Manoj Baseshankar	HOD, Mechanical Engineering	Suryodaya Polytechnic & Engineering College, Nagpur
8	Dr. Suhas Kongre	Sr.Lecturer in Mechanical	ASTS Polytechnic, Wardha

(Dr. G.K Awari)
HOD & Chairman PBOS, AE

(Dr. G. V. Gotmare)
Member Secretary PBOS, AE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/TX/AE/CM/MK/AI
Course Category	:	GE
Course Code	:	PK292H
Course Title	:	Folding Cartons & Corrugated Boxes

I Rationale:

In the packaging industry, folding cartons and corrugated boxes are among the most widely used packaging solutions. To design, convert, and apply these effectively, it is essential to understand the raw materials—primarily paperboard and corrugated board—their properties, structure, and behavior during conversion processes. This course provides foundational knowledge of paperboard and corrugated board materials, their manufacturing and conversion techniques, structural design, and practical applications in packaging. It prepares students with the skills needed to work with various carton and box formats used across industries.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Comprehend the knowledge of papers and their conversion processes for packaging applications.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the given types of paperboard materials used in folding cartons and appriciate sustainability.

CO2: **Evaluate** carton designs and test for balance between aesthetics and functionality.

CO3: **Apply** modern trends in carton manufacturing, such as laser cutting, by observing demonstrations

CO4: **Operate** machines for converting corrugated boards into boxes, and demonstrate sealing methods.

CO5: **Evaluate** testing methods and conduct compression tests on corrugated boxes and quality control measures and perform simple quality checks.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	2	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Material Selection for Folding Cartons	1a	Identify the given types of paperboard materials used in folding cartons.	1.1	Folding Cartons; Introduction. Raw material; Paperboards: SBS (Solid Bleached Sulfate), FBB (Food and Beverage Board), WLC (White Lined Chipboard), their composition and applications, Glue; composition.	CO1
	1b	Compare various coatings and laminates.	1.2	Board coating and lamination processes: UV coatings, aqueous coatings, PE laminates, and their applications.	
	1c	Calculate the given strength parameter using standard testing methods for Paperboards.	1.3	Grain direction, caliper selection and typical properties; whiteness, stiffness, Bursting Strength, GSM or Grammage, and Cobb, folding endurance test.	
	1d	Justify the importance of using Sustainable materials in folding carton manufacturing.	1.4	Sustainable materials: Recyclable, biodegradable, and compostable paperboards; concepts and importance.	

	1e	Justify the importance of FDA compliant packaging.	1.5	Food safety standards (FDA, EU) and compliance for food-grade packaging (folding cartons); glimpses.	
UNIT II: Structural Design and Prototyping of Folding Cartons	2a	Identify and sketch the structural elements of a folding carton.	2.1	Basic design elements: Tucks or tabs, flaps, locking mechanisms, and their impact on carton strength.	CO2
	2b	Justify the importance of using CAD tools in prototyping.	2.2	CAD tools (Introduction): ArtiosCAD, Packly, and prototyping techniques and there advantages.	
	2c	Apply the nesting concept for Folding Carton Manufacturing.	2.3	Die-line creation, nesting for material optimization, and common errors to avoid.	
	2d	Compare different folding carton styles.	2.4	Carton styles (features): Straight tuck end, reverse tuck end, crash lock (self-locking bottom), specialty cartons and their industrial uses.	
	2e	Justify the importance of branding elements and functional	2.5	Incorporating branding elements and functional considerations.	
anufacturing Processes for Folding Cartons	3a	Compare different steps in folding carton manufacturing on given points.	3.1	Overview of folding carton manufacturing (steps): Material selection, Printing, die-cutting, folding, and gluing. Printing with offset press;	CO3
	3b	Identify the given elements of a flat die and blanking tools.	3.2	Die-cut & punching; process steps. Flat die; construction, elements and their functions. Blanking tools.	
	3c	Justify the use of platen press for die cutting and punching.	3.3	Uses of platen press for die cutting & punching.	
	3d	Justify the importance of laser cutting process in folding carton manufacturing.	3.4	Laser cut cartons; Manufacturing process steps, advantages and limitations.	

UNIT III: Ma	3e	Identify the elements of a tetra pack wall structure and style of cartons.	3.5	Tetra pak; Introduction, raw material, mfg. process , Tetra pack wall structure; functions of each element. Different styles of tetra pack cartons, their applications.	
UNIT IV: Raw Materials and Components for Corrugated Boxes	4a	Identify differences between folding cartons and corrugated boxes by categorizing samples.	4.1	Corrugated Fiberboard Box (CFB); Introduction, carton and box comparison. Raw material; Liner board, fluting medium and Adhesive. Corrugated Fiberboard and Solid fiberboard comparison.	CO4
	4b	Compare different types of corrugated boards and flutes by handling and investigation.	4.2	Types of flutes: their specifications and applications. Types of Corrugated fiberboards: Singe Facer, Single-wall, double-wall, triple-wall structure and applications.	
	4c	Justify the importance of the raw material used for glue formation.	4.3	Glue formulation; glue kitchen, raw material, glue making. Glue consumption.	
	4d	Justify the importance of various operations involved in corrugated box manufacturing (CFB).	4.4	Creasing, slotting, die-cutting, gluing, taping, and sealing operations with machines used.	
	4e	Compare Single-piece with two-piece blanks on given points.	4.5	Single-piece vs. two-piece blanks: Construction, applications, and benefits.	
ing	5a	Justify the importance of various structural design considerations for a corrugated board manufacturing.	5.1	Structural design considerations; Wall thickness, flute types, box dimensions (Internal & Outer). Various box styles (RSC, HSC, die-cut, trays), and their applications.	

UNIT V: Corrugated Box Design and Manufacturi	5b	Justify the importance of different styles of palletiziting corrugated boxes.	5.2	Palletizing styles (Brick and others) – advantages & limitations; Introduction to prototyping software.	CO5
	5c	Identify CFB box manufacturing steps	5.3	CFB Box Manufacturing Steps: Board making, Printing, Slotting/Die-cutting, Folding, Gluing, Bundling, Strapping.	
	5d	Find out the strength of the corrugated board by given IS testing methods.	5.4	IS Testing methods: BS, BCT, ECT, RCT, Cobb, Puncture Resistance; Standard QC tests: Grammage, Caliper, BCT, Delamination, Barcode readability.	
	5e	Identify the defects in CFB Box manufacturing and Propose remedies.	5.5	Common Defects and Remedies in CFB Box Manufacturing; Issues like washboarding, soft boards, improper joints, fishtailing, delamination – causes and solutions.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify and compare various types of paperboards used in the production of folding cartons. Collect samples of three different types of cartons; compare the characteristics such as style of carton, board colour, texture, thickness and weight.	2#	CO1
I	2	Conduct tests to determine the grain direction of the paperboard.	2#	CO1
I	3	Conduct the test to determine the whiteness of the paperboard.	2	CO1
I	4	Carry out the burst strength test and calculate the burst factor of the paperboard.	2#	CO1
I	5	Perform folding endurance test – for paperboard.	2	CO1
II	6	Prepare a report on comparison of different folding carton styles by collecting any three samples.	2#	CO2
II	7	Design a basic folding carton style. Draft the design on paperboard, ensuring correct dimensions and folding lines. Cut and fold the carton to demonstrate the style.	2#	CO2
III	8	Create a prototype of a folding carton based on the previous (Practical No - 2) design. Cut, crease, and fold the carton prototype. Glue or tape the carton as needed. Measure the internal and external dimensions of the same.	2#	CO3
III	9	Prepare a report on "Elements of a Flat Die" by observing a real flat die.	2#	CO3
VI	10	Conduct Cobb test to find out water absorptiveness of kraft paper/ paperboard/corrugated fiberboard.	2#	CO4
VI	11	Explore Corrugated Fiberboard Types. Identify and compare three different types of corrugated fiberboards. Inspect and compare them on the basis of Board thickness, Flute type and Flute count.	2#	CO4
V	12	Conduct Edge crush / Ring crush test/ Flat crush test to find out edge crush strength of corrugated fiber board.	2#	CO5
V	13	Perform Puncture test to find out puncture resistance of paperboard/ corrugated fiber board.	2	CO5

V	14	Measure Internal and External Dimensions of a Regular Slotted Container (RSC) Box.	2#	CO5
VI	15	Operate Single Facer - Corrugated Board Making Machine. Set up the machine for two ply board production. Feed the material into the machine and execute the board-making process.	2#	CO6
VI	16	Operate creasing and slitting machine. Set up machine for a suitable job. Execute creasing and cutting operation.	2#	CO6
VI	17	Identify and resolve common defects in box making. Collect and inspect boxes for common defects such as fishtailing, delamination, soft board, or poor slotting. Identify the causes of the defects and suggest corrective actions.	2#	CO6
VI	18	Operate Box Stapler and Strapping Machine to Seal and Reinforce Corrugated Boxes.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Material Selection for Folding Cartons	6	C	2	6	4	12
			O	0	0	0	0
2	Structural Design and Prototyping of Folding Cartons	6	C	2	6	4	12
			O	0	0	0	0
3	Manufacturing Processes for Folding Cartons	6	C	2	6	4	12
			O	0	0	0	0
4	Raw Materials and Components for Corrugated Boxes	6	C	6	8	4	18
			O	0	0	0	0
5	Corrugated Box Design and Manufacturing	6	C	4	6	6	16
			O	0	0	0	0
Total		60	C	16	32	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q 1 to Q. 35	1R2	1U2	1U2	1U2	1A2	1A2	2R2	35/35
	2U2	2U2	2U2	2A2	2A2	3R2	3U2	
	3U2	3U2	3A2	3A2	4R2	4R2	4R2	
	4U2	4U2	4U2	4U2	4A2	4A2	5R2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Attendance & Punctuality	5
2	Regular Lab Performance	5
3	Record/Journal Submission (Quality of work / Neatness)	5
4	Viva Voce (During Sessions)	5
5	Internal Practical Test (Mock)	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-
CO2	3	-	1	2	-	-	2	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	1	-	-	-	-	-	-
CO5	3	-	-	2	-	-	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, PHILPL, 2E, 2014.	13: 978-81-203-5054-0
2	Handbook on Pulp & Paper Industries	SIRI Board of Consultants & Engineers, SIRI Pub., 1990.	10: 81-85480-24-9
3	The Wiley Encyclopedia of Packaging Technology	Kit L. Yam,, John Wiley & Sons Inc., 3E, 2010.	13: 9780470541395
4	The Packaging Designers Book of Patterns	Laszlo Roth, George L/ Wybenga, Wan Nostrand, Reinhold, 1991.	10: 0-442-00524-5
5	Paper, Paper Converting, Plastics & Other Pkg. Ind.	R. K. Kush, SBP Pub. Co., 1995.	--
6	Handbook of Pulp & Paper Technology	Kenneth W. Britt, CBS Publishers, 2E, 2004.	13: 9788123911441, 10: 8123911440

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3. http://www.fibrebox.org/Info/WhatIsCorrugated.aspx assessed on 13 aug 2024
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8. https://www.internationalpaper.com/packaging/solid-fiber assessed on 13 aug 2024
9. https://www.tetrapak.com/en-in assessed on 13 aug 2024
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XVI List of Major Equipment/Machineries with Specification:

1. Analog Substance Indicator/GSM Tester/ Electronic Weighing Machine.
2. Bursting Strength Tester.
3. Universal Testing Machine.
4. Compression Tester- ECT/FCT/RCT, etc.
5. Thickness Gauge.
6. Puncture Strength Tester.
7. Brightness Tester.
8. Folding Endurance Tester.
9. Sigle Facer- corrugattor machine
10. COBB Tester
11. Creasing and cutting machine
12. Portable staplers, Box stitching machine & Box strapping machine

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. Syed Imran Ahmed K.	I/c. Head of Packaging Technology.	Government Polytechnic, Nagpur.
2	Mr. Subhash N. Madhugiri	Rtd. Head of Department, Packaging Technology.	Government Polytechnic, Nagpur.
3	Mr. Rajesh S. Raool	Rtd. Lecturer in Packaging Technology	Government Polytechnic, Nagpur.
4	Mr. Prasd B. Iyer	Director	SIES School of Packaging, Mumbai.
5	Mr. Uday D. Raut	Managing Director	B.R. Plastic Industries, MIDC, Nasik.
6	Mr. Ali M. Zeeshan M.S.M	Assistant Prof. in Mechanical Engineering	Anjuman College of Engineering Nagpur.

(Mr. Syed Imran Ahmed K.)
HOD & Chairman PBOS, PK

(Dr. G. V. Gotmare)
Member Sectretary PBOS, PK

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/MC/MT/PK/TX/AE
Course Category	:	GE
Course Code	:	CM292H
Course Title	:	Web Development

I Rationale:

Web Page Design is used to develop online applications for various organizations such as organizational and educational websites, virtual learning environments, business applications in various fields such as products, sales,banking railways reservation, services etc. Web pages are categorized into two namely: static and dynamic web page. This course introduces web page design using HTML5 and also give emphasis on learning Cascading Style Sheets (CSS) which is a style sheet language used for describing the presentation of a document written in a markuplanguage for formatting and styling of content.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use development tools and integrated development environments (IDEs).

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Design** a webpage using HTML formatting tags.

CO2: **Develop** web page using list and hyperlinks.

CO3: **Develop** web pages using images, colors and backgrounds

CO4: **Design** HTML forms using table and frames

CO5: **Develop** presentation schemes on content using CSS.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to HTML	1a	Identify the characteristics of the given type of web sites.	1.1	Introduction of HTML:- Definition,history,importance, characteristics.	CO1
	1b	Select structure of the given HTML page.	1.2	Terminologies used in Web Design: World Wide Web(www), Web Pages, Web Site, Web Browsers, Web Servers and types of sites. Static vs. dynamic web sites,Search Engine.	
	1c	Choose Head tag and body tag in the given web page code.	1.3	Web page structure: DOCTYPE, HTML, TITLE,HEAD, BODY and other meta tags with attributes.	
	1d	Select procedure of using the given block level tag on a web page.	1.4	Block Level Elements: Headings, Paragraphs, Breaks, Divisions, Centered Text, Block Quotes, Preformatted text, types of Address, HR tag. Horizontal Rule.	
	1e	Select the procedure of using the given Text level tag.	1.5	Text Level Elements: Bold,Teletype,Underline,Strikethrough ,Superscript, DIV tag, displaying special characters,comments.	
s	2a	Identify given type of List.	2.1	Lists: Ordered Lists, Unordered Lists, Definition Lists, Nested Lists.	

UNIT II: Lists and Links	2b	Select appropriate types of Links for given situation.	2.2	Links: Absolute, Relative and Inline links, use image as link,link to an email address, button as link, types of links,linking various documents for internal and external links, to link different web page of same site, link different location on the same web page, a specific location on different web page of same site, to specific section within the document, inserting E-mail link	CO2
UNIT III: Images, Colors and Background	3a	Select the proper image attribute for web page code.	3.1	Image: Types of image format, jpg, bmp, png gif etc.IMG tag, alternate text, image alignment, HSPACE,VSPACE, wrapping text, height and width of images,Image as a link, Inserting Images, formatting image for sizing, alignment. Border and using other attributes with IMG tag.	CO3
	3b	Identify process of using the given colors/images as page background on a web page.	3.2	Colors and Backgrounds: The text color, color attribute of FONT tag, text attribute of BODY tag. bgcolor attribute of BODY tag, changing link colors: link, alink,vlink, attributes of BODY tag, Backgrounds: Inserting image as page background, background attributes of BODY tag, creating solid color page background.	
V: Table, Frames and Forms	4a	Choose the proper table tags and table attributes for given table.	4.1	Table: Table tag with attributes. TABLE, <tr>, <th>,<td> tags. Border, cell spacing, cell padding, width, align,bgcolor attributes. Adding captions: CAPTION tag.	CO4
	4b	Select proper types of table attributes for given senario.	4.2	Formatting contents in the table cells: align,valign,bgcolor, height, width, nowrap attributes. Spanning rows and columns: rowspan and colspan attributes.	
	4c	Identify type of 'frame' with examples and procedure to organize display as per given screen layout using frames.	4.3	Frames: Types of Frames with their attributes, Creating frames: FRAMESET tag – rows, cols attributes, FRAME tag – name, frame border, margin height, margin width, src, resize, scrolling Attributes, Use of NOFRAMES tag, Frame targeting.	

UNIT IV	4d	Choose basic form using different form fields and Button tags.	4.4	Forms: Creating basic form: FORM tag, action and method attributes, Form fields: Single line text field, password field, multiple line text area, radio buttons, and check boxes. Pull down menus: SELECT and OPTION tags. Buttons: submit, reset and generalized buttons.Formatting technique: Using table to layout form.	
UNIT V: Cascading Style sheets	5a	Idnetify CSS code for the given type of formatting on a web page with different CSS properties.	5.1	Cascading Style Sheets: Different types of Style Sheets, Benefits of using CSS. Adding style to the document: Linking to style sheets, Embedding style sheets, Using inline style, Selectors: CLASS rules, ID rules.	CO5
	5b	Identify the procedure to create CSS for applying the given presentation scheme on a web page.	5.2	Style sheet properties: Font, text, box, color and background properties.	
	5c	Select the procedure to create internal, inline and external CSS for applying the given presentation scheme on a web page.	5.3	Creating and Using a simple external CSS file; Using the internal and inline CSS;background and color gradients in CSS Setting font and text in style sheet using table layout.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Use following HTML Tags for webpage design- <HTML>, <HEAD>, <TITLE>, <BODY> elements.	2#	CO1
I	2	Design Web page and apply some block level tags and some text level tags.	2#	CO1
I	3	Design Web page using font Color, font face, font size, background color.	2#	CO1
II	4	Design Web page including- i) Ordered lists ii) Unordered list iii) Nesting list	2#	CO2
II	5	Design Web page including links in a Web page. Local page in same folder • Page in different folder. • Page in web. • Specified location within document.	2#	CO2
III	6	Design a web page using Image tags with height and width and also Used for background image.	2#	CO3
III	7	Design a web page to link a different web page of same site and create webpage using Image tags with height and width and also Used for background image.	2#	CO3
IV	8	Design table in web page using basic tables tags- <table>, <tr>, <td>, <th>	2#	CO4
IV	9	Design a web page to create a web page using Table tags a)Using rowspan and columnspan b)Background Image in a table.	2#	CO4
IV	10	Create a web page using Table tags a)Create table of 3 rows and Columns b) Having border , border size, border color c) Image in a particular cell	2#	CO4
IV	11	Create a web page to implement frame tags.	2#	CO4
IV	12	Create a web page using Form tag. Example:-Admission Form.	2#	CO4
V	13	Develop HTML page to demonstrate Inline CSS.	2#	CO5
V	14	Develop HTML page to demonstrate Internal CSS.	2#	CO5
V	15	Develop HTML page to demonstrate External CSS.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to HTML	6	C	04	06	04	14
			O	00	00	00	0
2	Lists and Links	6	C	02	06	06	14
			O	00	00	00	0
3	Images, Colors and Background	6	C	04	04	06	14
			O	00	00	00	0
4	Table, Frames and Forms	6	C	02	06	06	14
			O	00	00	00	0
5	Cascading Style sheets	6	C	02	06	06	14
			O	00	00	00	0
Total		30	C	14	28	28	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	1U2	1U2	1U2	1A2	1A2	Q1 to Q35	
2	2R2	2U2	2U2	2U2	2A2	2A2	2A2		
3	3R2	3R2	3U2	3U2	3A2	3A2	3A2		
4	4R2	4U2	4U2	4U2	4A2	4A2	4A2		
5	5R2	5U2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of proper HTML Tags	5
2	Performance/Execution of program	10
3	Complete the practical in stipulated time	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	3	3	-	-	3	-	-
CO2	3	-	3	3	-	-	3	2	-
CO3	3	-	3	3	-	-	-	2	-
CO4	3	-	3	3	-	-	3	-	-
CO5	3	-	3	3	-	-	3	2	-
CO6	3	-	3	3	-	1	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Web Publishing with HTML and CSS.	Lemay Colburn,Pearson,	13: 978-0-672-33623-2
2	HTML and CSS Complete Reference	Thomos Powell,Tata McGraw Hil	13: 978-0-07-174170-5
3	Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Black Book	Kogent Learning Solutions Inc., Dreamtech Press, 2012	13: 978-9350045930

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1. https://www.geeksforgeeks.org/ accessed on 14th May 2024
2. https://www.w3schools.com/html/ , accessed on 14th May 2024
3. https://www.codecademy.com/learn/learn-html , accessed on 14th May 2024
4. https://www.learn-html.org/en/Links, accessed on 14th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer system with all necessary peripherals and internet connectivity.
2. Any Office Software
3. Any browser

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.M.V.Sarode	HOD, Computer Engineering	Government Polytechnic, Nagpur
2	Mrs.D.S.Nalinde	Lecturer in Computer Engineering	Government Polytechnic, Nagpur
3	Mr.P.S.Thakre	Lecturer in Computer Engineering	Government Polytechnic, Nagpur
4	Dr.U.B.Aher	Lecturer in Computer Engineering	Government Polytechnic, Nagpur
5	Dr.Rakesh Kadu	Assistant Professor, I.T	Ramdeobaba College of Engg, and Management, Nagpur
6	Mr.Dipak Dhote	Operations Manager	IT-Network Infosystems Pvt LTD,Nagpur
7	Mrs.V.A.Raje	System Analyst	MSBTE ,RO,Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/PK/AI/MT/AE/TX
Course Category	:	GE
Course Code	:	MK292H
Course Title	:	Computer Aided Design

I Rationale:

CAD (Computer Aided Design) technology is moving in the direction of greater integration of design activities & manufacturing activities. CAD is the use of computer system to assist in the creation modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, and improve communication through documentation. It also may be useful to generate assembly and manufacturing drawings.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use CAD software for design and drafting.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Use** CAD/CAM hardware and software.

CO2: **Develop** 2D geometric modeling features.

CO3: **Develop** 3D engineering model using solid modeling command.

CO4: **Use** advance features of 3D geometric modeling.

CO5: **Create** assembly of components and generate exploded view.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to CAD/CAM	1a	Use CAD/CAM software in industry.	1.1	Roles of computers in industrial Manufacturing, Introduction to: CAD/CAM, Product life cycle, Design process, Applications of CAD/CAM, CAD/CAM hardware.	CO1
	1b	Compare given softwares for use in CAD/CAM	1.2	Introduction to CAD/CAM software: CATIA, SolidWorks, Nx, CREO, M CAM, Del CAM	
cs of Geometric Modelling	2a	Differentiate between 2D and 3D parametric softwares.	2.1	Introduction to geometric modelling, 2D and 3D modelling, difference between 2D & 3D, parametric softwares.	CO2
	2b	Construct 2D geometric model.	2.2	Geometric construction methods: wireframe modeling, surface modeling, solid modeling, develop 2D Sketching of 3D model.	

UNIT II: Basi	2c	Use modification techniques and polting features.	2.3	Modeling facilities desired: drafting features, modelling features, editing features, annotations, dimensioning and constrains, Plotting features.	
UNIT III: Solid Modelling Basic	3a	Apply datum planes, axes, and points to construct 3D models.	3.1	Understanding/creating & Working with datum Planes, axis, points	CO3
	3b	Create 3D solid model by using Extrude, Revolve, Sweep command.	3.2	Creating Solid using Extrude,Revolve, Sweep command.	
	3c	Improve the developed 3D model by using Edit Round,chamfer commands.	3.3	Modifying & Regenerating by Edit Definition, Applying Round, chamfer, Rib, Auto round	
UNIT IV: Solid Modelling Advance	4a	Create 3D solid model using Holes, Spring & Threads.	4.1	Creating Holes, Spring & Threads using Helical sweep	CO4
	4b	Develop 3D solid model with the help of Swept blend, Helical sweep Warp, Applying Drift	4.2	Creat 3D solid model with the help of Swept blend, Helical sweep Warp, Applying Drift	
	4c	Reconstruct & modify the developed 3D solid model.	4.3	Copying features, Patterning, blending, View manager for Cross sections, customize screen, Environment	
UNIT V: Assembly Modelling	5a	Discriminate attributes of assembly.	5.1	Calling components, Constraining components, working with Layers & Visibility, Patterning	CO5
	5b	Produce assembly and animation to it	5.2	Creating Assembly features and animation	
	5c	Construct exploded views and orthographic views.	5.3	View manager, Exploded Views, projection views – Front, Top, side view and sectional views, BOM, drafting	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify different input and output devices used in CAD/CAM	2#	CO1
I	2	Install Creo software (open source software) on your personal computer.	2	CO1
II	3	Use basic draw commands to draw 2D drawing.	2#	CO2
II	4	Modify and Edit above drawing.	2#	CO2
II	5	Draw 2 dimensional figure using Solid Modeling sketcher commands.	2#	CO2
III	6	Develop a solid geometry by using Extrude.	2#	CO3
III	7	Develop a solid geometry by using Revolve.	2	CO3
III	8	Create 3 D solid modelling of any one engineering component	2#	CO3
IV	9	Create a hole in a solid body by using hole command.	2#	CO4
IV	10	Use helical sweep command to create springs and threads.	2#	CO4
IV	11	Use warp and drift command to rectangle box.	2#	CO4
IV	12	Apply swept blend command to form irregular shapes in a solid.	2	CO4
V	13	Call main assembly component and apply constrain on it.	2#	CO5
V	14	Complete the assembly and view it from all direction by using view manager.	2#	CO5
V	15	Apply the animation to moving part of assembly.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to CAD/CAM	2	C	02	04	00	6
			O	0	0	0	0
2	Basics of Geometric Modelling	3	C	02	06	00	8
			O	0	0	0	0
3	Solid Modelling Basic	8	C	02	06	08	16
			O	0	0	0	0
4	Solid Modelling Advance	10	C	06	10	08	24
			O	0	0	0	0
5	Assembly Modelling	7	C	04	06	06	16
			O	0	0	0	0
Total		30	C	16	32	22	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q1 to Q 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35
	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	3A2	4R2	4R2	4R2	4U2	4U2	4U2	
	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Use of proper commands	5
2	Creating geometic modelling.	10
3	Experiment writing work.	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	2	-	2	-	-
CO5	3	-	-	3	2	-	2	-	-
CO6	3	-	-	3	2	-	2	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	CAD/CAM (Computer Aided Design/ Computer Aided Manufacturing)	Mikell P. Groover & Emory W. Zimmers, Prentice Hall of India Pvt. Ltd., New Delhi, 05th Edition, 1997	13: 978-81-7758-416-5
2	CAD/CAM Principles and Applications	P.N.Rao, Tata McGrawHill Education Pvt. Ltd.,New Delhi, Third Edition, 2010	13: 978-0-07-068193-4
3	Pro Engineer Wildfire 4 for Designers	Sham Tickoo, Dreamtech Press, New Delhi, 2010	13: 978-81-7722-904-2
4	CAD/CAM/CIM	P. Radhakrishnan, S. Subramhanyam, V. Raju, New Age international Publisher, New Delhi, Second Edition	10: 81-224-1248-3
5	CAD/CAM Concept and Applications	Chennakesava R. Alavala, PHI Learning Pvt. Ltd, Delhi, Sixth Edition, 2015	13: 978-81-203-3340-6
6	CAD/CAM (Computer Aided Design/ Computer Aided Manufacturing)	Suresh Dalela & P.K.Jain, S. Chand & Company Ltd., New Delhi, First Edition, 2000	10: 81-219-1784-0

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2. https://www.youtube.com/watch?v=yywxb9DLtng, 24th May, 2024
3. https://www.youtube.com/watch?v=8w_rllesjPE&list=PLsazGtdtYPVv0odDDT7qLQq9Q_NTnKslI, 24th May, 2024
4. https://www.youtube.com/watch?v=lvm3dqCI0q4, 24th May, 2024
5. https://www.youtube.com/watch?v=pwrxlSpk8Es&list=PLNHkWfMqgWnIPONSaMUfVbtvP6GbzDyba, 24th May, 2024
6. https://www.youtube.com/watch?v=bYKbYLfpk6k&list=PLRhPac0z_f_EiuNLBs_E_lOt-OqJPpHD_R, 24th May, 2024
7. https://www.youtube.com/watch?v=voIA0VyLW9E, 24th May, 2024
8. https://www.youtube.com/watch?v=h7dhDe-fZeg, 24th May, 2024

XVI List of Major Equipment/Machineries with Specification:

1. CPU with Intel (R) Core (TM) i5 processor or higher latest version
2. A color monitor with highest 32 bit/ 64 bit color display and with screen
3. A scroll mouse.
4. Laser printer
5. Windows7 operating system or higher version
6. Any one open source modeling software at AICTE website
7. Projector
8. Antivirus
9. LAN networking

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. G.K.Awari	HOD Mechatronics	Government Polytechnic, Nagpur
2	Ms. K.P.Thaware	Lecturer in Mechatronics	Government Polytechnic, Nagpur
3	Prof.Vikas M.Mankar	I/c HOD, Electronics & Tele.Engg.	Priyadarshini Polytechnic, Nagpur
4	Dr.Hemant B.Warkad	Jr. Works Manager	Ordnance Factory Ambajhari (OFA), Nagpur
5	Dr. S.M.Kale	Lecturer in Electronics	Government Polytechnic, Amravati

(Dr. G. K. Awari)
HOD & Chairman PBOS, MK

(Dr. G. V. Gotmare)
Member Secretary PBOS, MK

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/MT/MK/AE/TX
Course Category	:	GE
Course Code	:	AI292H
Course Title	:	Basics of Artificial Intelligence

I Rationale:

This course provides a comprehensive introduction to the fundamental principles and methodologies of artificial intelligence (AI). Students will explore the concept of intelligence and the various methods for encoding knowledge in computer systems. The course covers essential AI elements, including problem formulation, problem space exploration, search algorithms, knowledge representation, inference, logic, and learning mechanisms. By the end of the course, students will have developed a solid understanding of these core AI components and their applications in real-world scenarios.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Comprehend the knowledge of the foundational concepts of AI

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the need of AI and its applications in real life.

CO2: **Use** appropriate search techniques for solving a AI problem

CO3: **Identify** the methods used for knowledge representation in developing logic for game playing.

CO4: **Apply** knowledge representation and reasoning methods for solving real world problems using Artificial Intelligence.

CO5: **Apply** AI knowledge in developing Internet of Things applications

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Artificial Intelligence	1a	Classify artificial intelligence on the basis of given point.	1.1	Definitions – Artificial Intelligence, History of AI, Evolution of AI	CO1
	1b	Distingusih between various types of AI on the basis of given points	1.2	Applications of AI in NLP, Robotics, Automation, Human Emothion recognition, Types of AI	
	1c	Select the intelligent agent from the given data.	1.3	Types of Agents, Intelligent Agent	
	1d	Justify the difficulties encounted while conducting the Turing Test	1.4	Agent Environment,Turing Test in AI	
UNIT II: Search Techniques in AI	2a	Select and justify given search technique on basis of given point.	2.1	Search Techniques in AI ,Search based problems- Slide bar puzzle problem,Tower of Hanoi	CO2
	2b	Choose a suitable heuristic function for solving given problem.	2.2	Uninformed Search Breadth first Search Depth First Search, Heuristic Search/ Informed Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search	

UNIT III: Game playing in AI	3a	Apply procedures on given function using given search.	3.1	Game Playing: The Minimax Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening	CO3
	3b	Apply specific search methods on particular game	3.2	Case study : Search in Game Playing	
UNIT IV: Knowledge Representation	4a	Differentiate between the various types of knowledge based on the given criteria.	4.1	Introduction to Knowledge representation, types of knowledge	CO4
	4b	Compare the given techniques on the basis of given data.	4.2	Techniques of knowledge representation-Logical Representation, Semantic Network Representation Frame Representation, Production Rules	
	4c	Represent the given knowledge using propositional logic.	4.3	Propositional logic in Artificial intelligence	
	4d	Represent the given knowledge using First order logic.	4.4	First-Order Logic in Artificial intelligence	
UNIT V: Role of AI in Internet ofThings (IoT)	5a	Identify the contribution of AI in making IoT work	5.1	Role of AI in making IoT sucessful, Applications of AI in IoT	CO5
	5b	Suggest 2 imaginations of future based on collaboration of AI and IoT	5.2	Real world examples of AI in IoT,Future of AI based IoT	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
II	1	Implement Hill climbing to solve 8-Puzzle problem	2#	CO2
II	2	Develop a program to solve Tower of Hanoi problem using recursion.	2#	CO2
II	3	Develop a program to perform the generate and Test Search using Heuristic approach	2#	CO2
III	4	Implement Best First Search to solve a problem using Heuristic approach	2#	CO3
III	5	Develop a program to perform breadth- first search of a given problem graph.	2#	CO3
III	6	Develop a program to perform depth- first search of a given problem graph.	2#	CO3
IV	7	Develop a program to solve family tree problem using rules	2#	CO4
IV	8	Design an application to simulate number puzzle problem	2#	CO4
V	9	Implement water jug problem using artificial intelligence technique	2#	CO5
V	10	Implement the program based on Minimax Search for designing the Tic-Tac-Toe game	2#	CO5
V	11	Develop a program to solve the Travelling Sales person Problem using Heuristic approach	2#	CO5
V	12	Develop a program to solve the Slide bar puzzle problem using Heuristic approach	2#	CO5
V	13	Develop a mini project on Automated inventory tracking using IoT	2	CO5
V	14	Develop a mini project on IoT in Healthcare.	2	CO5
V	15	Develop a mini project on IoT in any other application.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Artificial Intelligence	6	C	02	04	10	16
			O	00	00	00	00
2	Search Techniques in AI	6	C	02	04	06	12
			O	00	00	00	00
3	Game playing in AI	6	C	02	04	06	12
			O	00	00	00	00
4	Knowledge Representation	6	C	02	02	10	14
			O	00	00	00	00
5	Role of AI in Internet ofThings (IoT)	6	C	02	06	08	16
			O	00	00	00	00
6			C	00	00	00	0
			O	00	00	00	00
Total		30	C	10	20	40	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q 1 to Q 35	1R2	1U2	1U2	1A2	1A2	1A2	1A2	35/35
	1A2	2R2	2U2	2U2	2A2	2A2	2A2	
	3R2	3U2	3U2	3A2	3A2	3A2	4R2	
	4U2	4A2	4A2	4A2	4A2	4A2	5R2	
	5U2	5U2	5U2	5A2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Writing Program (Execution)	5
2	Performance	10
3	Showing Execution Process and outcome	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	3	-	3	-	-
CO2	3	-	-	3	3	-	3	-	-
CO3	3	-	-	3	3	-	3	-	-
CO4	3	-	-	3	3	-	3	-	-
CO5	3	-	-	3	3	-	3	-	-
CO6	3	-	-	3	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Artificial Intelligence	E. Rich and K. Knight and ShivashankarB.Nair.,3rd Edition, Tata McGraw Hill, 2008	13: 978-0-07-067816-3, 10: 0-07-067816-2
2	Artificial Intelligence - A Modern Approach	S. Russell and P.Norvig, Pearson Education, 4th edition, 2020	13: 978-0-13-604259-4
3	Introduction to Artificial Intelligence & Expert Systems	Dan W Patterson, PHI Learning, 1st Edition, 2011	13: 9789332551947

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2. http://www.dkriesel.com/en/science/neural_networks, accessed on 29th May 2024
3. https://www.youtube.com/results?search_query=artificial+intelligence, accessed on 29th May 2024
4. https://www.youtube.com/watch?v=s-s9ilkMVj8, accessed on 29th May 2024
5. https://www.javatpoint.com/subsets-of-ai, accessed on 29th May 2024
6. https://www.youtube.com/watch?v=s-s9ilkMVj8, accessed on 29th May 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer system with latest configuration.
2. Software: opensource framework, AItools (Scikit Learn,TensorFlow,Auto ML,H2O,google ML kit)

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A R Mahajan	HOD, Information Technology	Government Polytechnic, Nagpur
2	Dr.Paresh R. Kamble	Machine Learning specialist	OZ SportZ, Nagpur, HQ-Reykjavik, Iceland
3	Dr. Vijaya Balpande	Associate Professor	Priyadarshini College of Engg., Nagpur
4	Mrs. Shifa Azharuddin	Lecturer in Information Technology	Government Polytechnic, Nagpur
5	Dr. S. S. Gharde	Lecturer in Information Technology	Government Polytechnic, Nagpur

(Dr. A. R Mahajan)
HOD & Chairman PBOS,

(Dr. G. V. Gotmare)
Member Secretary PBOS,

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/CM/PK/MT/AE/AI/MK/TX
Course Category	:	GE
Course Code	:	TR292H
Course Title	:	Wildlife Tourist Guide / Naturalist

I Rationale:

Over a period of time, it has been observed that efficiency of polytechnic student can be increased at the workplace by imparting key skills right from entry to the polytechnic. It is an effort to develop student that enables him to be successful in finding a practical and quick solution to any problem he comes across. It covers more or less all aspects of life skills. The development of subject is progressively ascending parallel to development of study in polytechnic.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Facilitate guided wildlife and nature tours with strong communication, safety, and interpretive storytelling skills.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Classify** the concept of Tour Guiding and Naturalist.

CO2: **Identify** the key communication and behavior skills for Guide.

CO3: **Identify** types of products for tour guiding and types of tourists.

CO4: **Identify** and understand the tourist behavior and expectations.

CO5: **Identify** technical and storytelling skills required for effective tour guiding.

CO6: **Identify** various hygiene, safety and documentation process.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	25	10

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction	1a	Classify the duty of tour guiding.	1.1	Introduction of tourism industry. Background of tour guiding Duty and responsibilities.	CO1
	1b	Identify the role of wildlife tourism in India.	1.2	Wildlife tourism in India, Role of Naturalists.	
	1c	Identify the local experience and excursion.	1.3	Introduction of Local excursion and experiences.	
UNIT II: Communication Skills	2a	Identify skill set.	2.1	Learn basic communication skills required for the profession.	CO2
	2b	Relate skills with profession.	2.2	Etiquettes and behaviour.	
	2c	Recognize the types of skills.	2.3	Presentation skills and storytelling.	
	2d	Identify the hard skills.	2.4	Hard skills and domain knowledge.	
IT III: Tour ing Products	3a	Recognize the types of Products.	3.1	Types of tour.	CO3
	3b	Recognize product for tour guiding.	3.2	Types of products for tour guiding, costing, inclusion etc.	

UNI Guid	3c	Identify type of tourist.	3.3	Types of tour for different types of tourist.	
UNIT IV: Tourist Expectation	4a	Identify behavior of tourist.	4.1	Types of tourist, Types of destination, Types of tour, Behaviour of the tourist at the destinations.	CO4
	4b	Identify expectation of Tourist.	4.2	Understating the expectation and outcome of the tour.	
	4c	Identify communication and importance of feedback.	4.3	Communication during the tour, feedback and testimonials.	
UNIT V: Component of the Wildlife Destination	5a	Classify Wildlife Tourism products.	5.1	Different types of Destination, Inbound and Domestic Market, Eco system of the wildlife Industry.	CO5
	5b	Identify types of components of the wildlife tourism products.	5.2	Understanding flora and Fauna of the wildlife destination.	
	5c	Prepare pitch for storytelling.	5.3	Art of Story Telling. Short and long pitch, content creation for the story telling.	
UNIT VI: Hygiene, Safety & Documentation	6a	Identify use hygiene in tourism industry.	6.1	Understanding the importance of hygiene during tours, Tips to maintain hygiene during tour and making connections with tourists.	CO6
	6b	Use of safety guidelines for tourist.	6.2	Safely at the destination and while taking walking tours. Important checklist for the safety of tourists.	
	6c	Identify use of tour guiding documentation.	6.3	Tour Guiding documentation.	
	6d	Use of procedures pre during and post tours.	6.4	Pre service and Post service procedure, Maintaining documents.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare the list of types of wildlife and historic destination in Vidarbha.	2#	CO1
I	2	Prepare and present the importance of wildlife tourism in India.	2#	CO1
II	3	Prepare and present a role play for tour guiding profession.	2#	CO2
II	4	Prepare a story for oral narration with respect to a wildlife destination.	2#	CO2
III	5	Present the Tourism Products.	2	CO3
III	6	Prepare a present a role plays of types of tourists.	2	CO3
III	7	Prepare report on the product of tour guiding.	2#	CO3
IV	8	Prepare Roleplay on Tourist behavior.	2#	CO4
IV	9	Prepare report on tourist expectation at different types of destination.	2#	CO4
IV	10	Prepare feedback form for tourist visiting wildlife destination.	2	CO4
V	11	Demonstarte wildlife Story telling.	2#	CO5
V	12	Submit the assignment of a destinations flora and fauna in the form of story telling.	2#	CO5
VI	13	Prepare the documentation chekist for an organization managing wildlife tourism activities.	2#	CO6
I to VI	14	Presents your self as a wildlife tourist guide.	2#	CO1 to CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Not Applicable.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction	5	C	02	04	00	6
			O	0	0	0	0
2	Communication Skills	5	C	02	08	00	10
			O	0	0	0	0
3	Tour Guiding Products	5	C	02	04	12	18
			O	0	0	0	0
4	Tourist Expectation	5	C	02	04	06	12
			O	0	0	0	0
5	Component of the Wildlife Destination	5	C	02	04	06	12
			O	0	0	0	0
6	Hygiene, Safety & Documentation	5	C	00	08	04	12
			O	0	0	0	0
Total		30	C	10	32	28	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q1 to Q 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35	
	2U2	3R2	3U2	3U2	3A2	3A2	3A2		
	3A2	3A2	3A2	4R2	4U2	4U2	4A2		
	4A2	4A2	5R2	5U2	5U2	5A2	5A2		
	5A2	6U2	6U2	6U2	6U2	6A2	6A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	10
2	Overall Presentation of given assignment	10
3	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	3	-	3	-	-
CO2	3	-	-	-	3	-	3	-	-
CO3	3	-	-	-	3	-	3	-	-
CO4	3	-	-	-	3	-	3	-	-
CO5	3	-	-	-	3	-	3	-	-
CO6	3	-	-	-	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Wildlife Tourism Resources	Chiranjeev Avinash, Jnanada Prakashan,	13: 9788171391738
2	Working in Wildlife Tourism: A handbook for guides, small business, students and NGOs	Ronda Green, Green Publications, 2023	
3	Tourism and Biodiversity	Romila Chawla, Sonali Publisher.	13: 978-8188836727

XV e-References:

1. https://www.wildlifetrip.in/accessed on 15 nonember 2024
2. https://www.naturesafariindia.com/wildlife-in-india/indian-wildlife/accessed on 15 nonember 2024
3. https://www.responsibletravel.com/holidays/india-wildlife/travel-guide/accessed on 15 nonember 2024
4. https://www.wildlife-safari-india.com/accessed on 15 nonember 2024
5. https://thewildlifetour.com/accessed on 15 nonember 2024
6. https://www.nathab.com/know-before-you-go/asia-the-pacific/india/wildlife-guid/accessed on 15 nonember 2024
7. https://www.insideindianjungles.com/accessed on 15 nonember 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer with internet connectivity.
2. Projector with screen.
3. World map, Map of India, Maps of Indian states and Union Territories.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.P. P. Virkhare	HoD, Travel and Tourism Department.	Government Polytechnic, Nagpur.
2	Mr Rajesh P Pund	Lecturer in Travel and Tourism	Government Polytechnic, Nagpur.
3	Dr Aarti Meshram	I/c Principal	GIHMCT, Nagpur.
4	Miss Erika Kar	Director	Pegasus Institute, Nagpur.
5	Mr Adityashekhar Gupta	Director	Horizon Safaris, Nagpur.
6	Dr Arvind Upasani	Visiting Lecturer	RSTM Nagpur University.

(Dr. P. P. Virkhare)
HOD & Chairman PBOS, TR

(Dr. G. V. Gotmare)
Member Secretary PBOS, TR

Exit Course

II Year

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AE/MT/PK/TX/MK/AI
Course Category	:	INP
Course Code	:	IN252H
Course Title	:	Internship (Vocational Skills)

I Rationale:

The Internship (Vocational Skill) course is a vital component for fulfilling the requirements of the diploma in vocation after the fourth semester as per NEP guidelines as an exit course. It provides students with hands-on experience in small, medium, or large-scale industries related to their field of study. This course bridges the gap between academic learning and practical application, enabling students to apply their theoretical knowledge in real-world industrial settings, enhancing their employability and vocational competencies.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Bridge theoretical knowledge with practical experience in a professional environment.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Evaluate** the organization's structure, processes, safety protocols, and industry standards to determine operational effectiveness.

CO2: **Apply** industry-specific tools, technologies, and skills to perform various operations.

CO3: **Contribute** to organizational goals by handling projects/ tasks under mentor guidance, applying learned skills.

CO4: **Analyze** technical challenges, addressing industry-specific issues effectively.

CO5: **Prepare** a internship report, ensuring accuracy and clarity.

CO6: **Deliver** presentation using visual aids and effective communication.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	-	8	8	4

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	-	-	-	-	50	20

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)	Topics and Sub-topics	Aligned Cos

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Learn the organization's structure, operational workflow, safety standards, industry practices, methodologies, technologies, and workplace processes to analyze operational efficiency and compliance requirements.	10#	CO1
II	2	Undergo training on industry-specific tools, technologies, and software, while gaining hands-on experience in performing basic operations, troubleshooting, and maintenance tasks, applying relevant skills to real-world industry scenarios and challenges.	20#	CO2

III	3	Participate in daily operations under mentor guidance, handling assigned projects or tasks aligned with industry needs, applying learned skills to contribute to organizational goals and gaining practical experience in real-world scenarios.	60#	CO3
IV	4	Identify and analyze technical challenges in industry, and address industry-specific issues (if any).	10#	CO4
V	5	Prepare a comprehensive internship report that effectively documents work experiences, technical tasks, and key achievements throughout theinternship. Ensure the accuracy of the content by cross-referencing with project details. Organize the report clearly, following industry standards.	10#	CO5
VI	6	Prepare a PowerPoint presentation on internship learnings, create and share a structured seminar outline, review technical documents, and present it.	10#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. During the summer vacations, after the 4th Semester, students are required to undergo internship with industry/ NGO"s/ Government organizations/ Micro/ Small/ Medium enterprises to make ready for the industry.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of industry	5
2	Work done and Feasibility of work	25
3	Daily diary, supervisor remark and report writing	10
4	Presentation	10
	TOTAL	50

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	1	3	3	-	-
CO5	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	3	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Industrial Training and Education	Lokesh Choudhary, Mittal Publications, 2007	10: 8183242367 13: 9788183242363
2	Training Practice	Penny Hackett, McGraw-Hill Education, September 2003	10: 0852929803 13: 9780852929803
3	AICTE Internship Policy: Guidelines & Procedures	All India council of Technical Education New Delhi	-

XV e-References:

1. https://internship.aicte-india.org/ assessed on 23rd April 2024
2. https://www.coursera.org/articles/computer-science-internships assessed on 23rd April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Desktop computers
2. Laser Printer
3. DLP

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. P. Mogre	Principal	Government Polytechnic, Nagpur
2	Dr. M. V. Sarode	HoD, Computer Engineering and I/C Trainining & Placement Officer	Government Polytechnic, Nagpur
3	Dr. G. V. Gotmare	I/C Curricullum Development Cell	Government Polytechnic, Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

Semester V

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	AM301H
Course Title	:	Design of Structures

I Rationale:

The Design of Structures subject is essential in preparing polytechnic students for the challenges they will face in the engineering field. It equips them with the technical knowledge, practical skills, and critical thinking abilities necessary to design safe, effective, and sustainable structures. By mastering this subject, students are well-prepared to contribute to the construction and infrastructure sectors and to pursue further specialization in structural engineering. Students learn about building codes, standards, and regulations that govern the design and construction of structures, ensuring that they can work within legal and safety frameworks.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Design and plan various Structural system & components using Limit state method.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Use** steel table and IS code 800:2007 at work sites.

CO2: **Design** connections for the given steel joints.

CO3: **Design** singly reinforced rectangular beams.

CO4: **Design** of shear reinforcement and development length for beam and slabs.

CO5: **Design** various slabs for the given edge condition.

CO6: **Design** axially loaded short columns and footings.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70 $	100	40	25	10	25+	10	25	10

$ 4 Hours Duration

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Fundamental of Steel Structures	1a	Select a relevant steel structure from steel table for the given condition.	1.1	Type of steel sections their grade and strength from steel Table, IS 808-1989, Stress Strain graph for mild steel.	CO1
	1b	Illustrate various type(s) of loads (Dead load, live load, impact load, seismic load, snow load etc.) acting on the given steel structures.	1.2	Loads acting on steel structures according to IS 875-1987 part I to IV.	
	1c	Choose the partial safety factor as per the guidelines laid in IS for the given situation.	1.3	Factors of safety and load factors as per IS 800:2007.	
	1d	Compare concrete with steel as construction material in the given situation.	1.4	Steel as construction material.	

	1e	Illustrate with justification the functions of the given steel structures.	1.5	Steel structures: Towers, Roof trusses, Water Tanks, Bridges, Columns, Chimney, building frames etc.	
UNIT II: Design of Steel Connections	2a	Compute the strength of the given bolted connections.	2.1	Types, uses of bolts and joints, Black bolts and High strength bolts, modes of failure, specification of bolt holes for bolted connections. Strength of bolt in shear, tension, bearing and efficiency of joint.	CO2
	2b	Design the bolted connections for the given situations.	2.2	Analysis and design of bolted joints for axially loaded plate, single and double angle members.	
	2c	Calculate the strength of the given welded connections.	2.3	Welded connections: Butt and Fillet welds, size of weld, throat thickness.	
	2d	Design the welded connections for given situations.	2.4	Analysis and design of Fillet welded joint for plate, single and double members subjected to axial load.	
	2e	Compare welded connections with bolted connections.	2.5	Comparison of welded connections with bolted connections.	
gly Reinforced Beam Sections	3a	Illustrate with justification partial safety factor as laid in IS provisions for the given situation.	3.1	Definition and types of limit state. Partial safety factors for materials and loads, characteristic strength as per IS456: 2000.	CO3
	3b	Draw stress-strain diagram.	3.2	Assumptions, stress-strain relationship for concrete and block diagram for singly reinforced section.	
	3c	Calculate design constants and ultimate moment of resistance.	3.3	Design parameters and constants, ultimate moment of resistance.	

UNIT III: Design of Sing	3d	Design balanced and under-reinforced singly reinforced rectangular sections.	3.4	Analysis and design – Numerical problems on determination of design constants, ultimate moment of resistance, ultimate load carrying capacity, design of balanced and under reinforced sections. I.S. specifications regarding spacing, cover, minimum reinforcement, effective span.	
UNIT IV: Shear reinforcement and development length	4a	Calculate ultimate shear strength of beam.	4.1	Meaning of shear in RCC beams and slab, IS code specifications IS:456:2000, various forms of shear reinforcement in beams, use of bent-up bars.	CO4
	4b	Design beam for shear reinforcement.	4.2	Numerical problems on design of beam for shear reinforcement.	
	4c	Calculate development length.	4.3	Meaning of bond and development length in RCC, IS code provisions and calculation of development length in tension and compression.	
UNIT V: Design of Slabs	5a	Identify type of slab from the given data.	5.1	Definition and classification of slabs as one-way and two-way slabs, support conditions, main and distribution steel, I.S.456:2000, specifications regarding spacing and cover for reinforcement, effective span, minimum reinforcement.	CO5
	5b	Design given types of slabs.	5.2	Design of slabs- Procedure and numerical problems on design of one-way simply supported slab, cantilever slab, two-way simply supported slab with corners free to lift.	
	5c	Draw reinforcement detailing diagram for slabs.	5.3	Reinforcement detail diagram for one-way , two-way and cantilever slabs.	

UNIT VI: Design of Column and Footing	6a	Illustrate with justification assumptions and define terms related to column.	6.1	Limit state of collapse in compression- assumptions, minimum eccentricity, slenderness ration, short and long columns.	CO6
	6b	Calculate ultimate load carrying capacity of a given axially loaded column.	6.2	Calculation of ultimate load carrying capacity of axially loaded short square, rectangular and circular columns.	
	6c	Design column and draw reinforcement detailing.	6.3	Design of axially loaded short square and circular columns.	
	6d	Design isolated sloped footing and draw reinforcement detailing.	6.4	Design of isolated square sloped footing- Flexural design with checks for one way and two-way shear.	
	6e	Compare given types of footings.	6.5	Introduction to various types of RCC footings like stepped, sloped, combined footing and piles.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Sketch/Draw tables/Graphs from IS code , standard rolled steel sections, built up sections.(1 Plate)	2#	CO1
II	2	Sketch/ tables type of bolts and weld and type of joints.(1 Plate)	2#	CO2
III	3	Sketch/Draw typical reinforcement details of R.C. sections based on concept of Limit state method.(3 Plates)	2#	CO3
III	4	Draw plan of (G+1) RCC residential building .	2#	CO3
III	5	Draw structural drawing showing c/s and longitudinal section of beam.	2#	CO3
IV	6	Design beam for approved plan.	2#	CO4
V	7	Design One-way slab for approved plan.	2#	CO5
V	8	Design Two-way slab for approved plan.	2#	CO5
V	9	Design cantilever slab for approved plan.	2#	CO5
V	10	Draw key plan, structural plan showing position of beam, column and footing.	2#	CO5
V	11	Draw structural drawing showing c/s and plan of one-way slab and cantilever slab.	2#	CO5
V	12	Draw structural drawing showing c/s and plan of Two-way slab .	2#	CO5
VI	13	Design column for approved plan.	2#	CO6
VI	14	Design footing for approved plan.	2#	CO6
VI	15	Draw structural drawing showing c/s and plan of Column & footing.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect structural drawing of any workshop truss and design the bolted connections.
2. Collect structural drawing of any workshop truss and design the welded connections.
3. Visit under construction building & deign all the the RCC rectangular beams as simply supported.
4. Visit under construction building & deign all the the RCC ' T ' beams as simply supported.
5. Collect plan of residential building and design all slabs as simply supported.
6. Collect plan of residential building and design all Columns.
7. Collect plan of residential building and design all footings.
8. Use IS:456 to prepare charts of Stress strain curve for singly reinforced rectangular beam, Doubly reinforced rectangular beam , Modification factor ; Table for maximum shear stress and bond stress chart.
9. Design Slabs using STAAD pro software and compare with manual design.
10. Design beam using STAAD pro software and compare with manual design.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Fundamental of Steel Structures	3	C	2	0	0	2
			O	0	4	0	4
2	Design of Steel Connections	8	C	10	4	8	22
			O	0	0	0	0
3	Design of Singly Reinforced Beam Sections	8	C	4	0	4	8
			O	0	4	6	10
4	Shear reinforcement and development length	4	C	2	0	0	2
			O	0	4	4	8
5	Design of Slabs	12	C	0	10	6	16
			O	8	4	0	12
6	Design of Column and Footing	10	C	0	4	16	20
			O	0	0	6	6
Total		45	C	18	18	34	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	3R2	4R2	5R2	5R2	5	2
2	2R4	2R4	2U4	5R4	1U4			3	2
3	2A4	2A4	3A4	3U4	4U4			3	2
4	6A4	6U4	5U4	5U4	4A4			3	2
5	5U6	5A6	3A6					2	1
6	6A6	6A6	6A6					2	1

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing different plates from IS code and structural details.	5
2	Writing Design procedure of various components for given building plan.	10
3	Drawing structural details of various components of given bulding plan.	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Collection of data.	5
2	Report writing	10
3	Calculation , Result	5
4	Presentation	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	-	3	-	3	3	-
CO2	3	3	3	-	3	-	3	3	-
CO3	3	3	3	-	3	-	3	3	-
CO4	3	3	3	-	3	-	3	3	-
CO5	3	3	3	-	3	-	3	3	-
CO6	3	3	3	-	3	-	3	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Limit State Design of Steel Structures	S.K. Duggal Mcgraw-Hill, Noida.	9351343499
2	Limit State Design of Steel Structures	Shah V.L. , Gore Veena ; Structures Publications, Pune	ISBN 13, 8190371754
3	Design of Steel and R.C.C. Structures	R.R. Gadpal , D.J. Khamkar , R.B. Narhari ;Nirali Prakashan	978-93-89108-13-2
4	Reinforced Concrete(Vol.1)	H.J. Shah , Charotar Publication, 12th edition ;Anand Gujrat	ISBN : 9789385039478
5	IS: 456-2000 ; Plain and Reinforced Concrete Concrete-Code of practice	Bureau of Indian Standards, Published-1987	--
6	IS:800-2007 ; General Construction in Steel-Code of Practice	Bureau of Indian Standards, Published-2007	--
7	IS-875 Part1 and part2 ; Code of practice for Design Loads	Bureau of Indian Standards, Published-1987	--

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5. https://youtu.be/A-8vHxueCMs ;accessed on 21st August 2024
6. https://youtu.be/hw3ko7OEmdA ;accessed on 21st August 2024
7. https://www.youtube.com/watch?v=9y7-NbHowo4 ;accessed on 21st August 2024
8. https://youtu.be/qaKf1Mo7ApM ;accessed on 21st August 2024
9. https://www.youtube.com/watch?v=IVFBAu7m2T4 ;accessed on 21st August 2024
10. https://www.youtube.com/watch?v=4sDtor5tOmo ;accessed on 21st August 2024

XVI List of Major Equipment/Machineries with Specification:

1. N. A.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	H.L. Wahane	Lecturer	Government Polytechnic, Nagpur
2	R.D. Dongarwar	Lecturer	Government Polytechnic, Nagpur
3	Abdul Ateeque Azher	Lecturer	Government Polytechnic, Nagpur

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE301H
Course Title	:	Hydraulics

I Rationale:

The Hydraulics course is crucial for Diploma Civil Engineering students as it educates them on the behavior of fluids in various environments. Students must learn how to identify the physical properties of fluids, measure the pressure at a point, and determine the total pressure and its application under specific conditions. The course will teach the students about discharges, energy heads, and head losses in fluid flow in pipes and open channels, and they will learn how to measure the velocity of flow using suitable devices. Additionally, students will learn how to choose the right pump for pumping liquids based on specific requirements. All of these course outcomes will prepare students for careers in water network design, drainage, and hydraulic system management.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Plan, Execute and maintain Hydraulic structures, pipelines, pumps and canals.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Determine** the physical properties, pressure and pressure differences in fluids.

CO2: **Determine** total pressure and its point of application under given conditions.

CO3: **Analyse** the flow in pipes using Continuity Equation and Bernaullis Equations.

CO4: **Design** Pipelines for transportation of fluids.

CO5: **Design** open channels for transportation of fluids.

CO6: **Select** pump for given conditions.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
s and Pressure Measurement	1a	Identify the application of hydraulics in the given field of Civil Engineering field.	1.1	Differences in behaviour of liquids and solids, Definitions of fluid, fluid mechanics, hydraulics, hydrostatics and hydrodynamics, Applications of hydraulics in Civil Engineering field.	
	1b	Compute physical properties of fluid from given data.	1.2	Physical properties of fluids – Specific Weight, Mass Density, Specific Gravity, Viscosity, Surface Tension, Capillarity, Bulk Modulus of Elasticity, Compressibility, Newton's Law of Viscosity, Ideal and Real fluids.	

UNIT I: Physical properties of fluids	1c	Convert given Pressures and Pressure differences from one system to other.	1.3	Pressure- Definition and its types- Atmospheric pressure, Guage pressure, Absolute pressure, Vacuum pressure, Free liquid surface, Pressure head, Pascal's Law of fluid pressure and its applications. Conversion of pressure head of one liquid in terms of the other liquid.	CO1
	1d	Determine pressure head at a point, difference of pressure between two points for the given data.	1.4	Measurement of pressure by using Piezometers, simple U tube manometers and Bourdons pressure guage. Measurement of difference of pressure by Differential U tube manometers and inverted U-tube manometers.	
UNIT II: Hydrostatics	2a	Develop pressure diagram for given situation.	2.1	Variation of pressure in horizontal and vertical direction. Pressure diagram – concept and use.	CO2
	2b	Determine total pressure and centre of pressure for given immersed surface.	2.2	Total hydrostatic pressure on immersed surfaces and on surfaces retaining liquids, Centre of pressure.	
	2c	Determine the resultant pressure and its position for given situation of liquid in a tank.	2.3	Computation of total pressure and centre of pressure on vertical, inclined and horizontal immersed surfaces.	
	2d	Determine the resultant pressure and its position under the given conditions.	2.4	Determination of total pressure and centre of pressure on sides and bottom of tanks containing two or more liquids, vertical surfaces in contact with liquid on either side.	

UNIT III: Fundamentals of fluid flow	3a	Differentiate between the given types of flow on given points.	3.1	Types of flow- Gravity and Pressure flow, Laminar and Turbulent, Steady and Unsteady, Uniform and Non uniform, Compressible and Incompressible, Various combination of flow through pipe and channel.	CO3
	3b	Interpret the type of flow using given Reynold's number.	3.2	Reynold's Number and its use in determination of type of flow.	
	3c	Calculate velocity and discharge in a given situation using continuity equation.	3.3	Discharge and its unit, Continuity equations of flow.	
	3d	Determine the given Energy/ Heads in flow under given situation.	3.4	Energy of flowing fluid: Potential, Kinetic and Pressure energy, Total energy.	
	3e	Apply Bernoulli's theorem to determine the given parameters under given situation.	3.5	Bernoulli's theorem- statement, assumptions, equation and Modified Bernoulli's Theorem.	
tanks	4a	Determine various head losses in a given pipe system.	4.1	Head losses nf flow -Major head Loss : Frictional head loss and its computation by Darcy-Weisbach equation h_f=(flv^2)/2gD, Hazen Williams Formula and Modified Hazen Williams formula, Minor loss of head in flow through pipe- Loss of head due to sudden expansion, gradual expansion, sudden contraction, gradual contraction, at entrance, exit and head loss in various pipe fittings such as bends, valves, elbows etc., Relatives roughness, Use of Moody's diagram and Nomograms for design of pipe.	

UNIT IV: Flow through pipes and	4b	Analyse the flow through pipes based on given situation.	4.2	Flow through pipes in series and parallel, compound pipe, Siphon, Dupit's equation for equivalent pipe, Hydraulic gradient line and Total energy line.	CO4
	4c	Prepare a chart showing causes, effects and preventive measures to avoid water hammer in pipes.	4.3	Water hammer –Causes, effects and preventive measures.	
	4d	Determine the discharge through a pipe based on given data of Venturimeter.	4.4	Discharge measuring devices for pipe flow: Venturimeter-Construction and working, Determination of its hydraulic coefficient.	
	4e	Determine the discharge through an Orifice on given data.	4.5	Discharge measuring devices for tanks: Orifice-Vena contracta Classification according to size, shape and discharge condition Hydraulic Coefficients. Relation between them. Determination of Cc, Cv, Cd of small sharp edge circular orifice discharging free.	
n channels	5a	Determine discharge in the given channel using relevant formulae for the given data.	5.1	Different shapes of artificial channels, Geometric properties of channel: - Wetted perimeter, Wetted area, hydraulic mean depth, Comparison of flow through pipe and open channel. Determination of discharge by Chezy's equation and Manning's equation.	
	5b	Design the most economical channel section for the given condition.	5.2	Conditions for most economical rectangular and trapezoidal channel sections.	

UNIT V: Flow through ope	5c	Determine the discharge in open channel under given situation.	5.3	Discharge measuring devices: Notches – types of notches- rectangular, triangular, trapezoidal, expression for discharge through them. Weir - Types, Expression for discharge over rectangular sharp crested weir, Cippoletti weir, Flumes – Venturi flumes, Standing wave flume, expression for discharge through flumes.	CO5
	5d	Draw the given device used for measurement velocity of flow.	5.4	Velocity measuring devices- Floats, Current meter, Pitot tube – expression for velocity.	
	5e	Interpret the type of flow in open channel from given Specific Energy diagram.	5.5	Specific Energy Diagram, Froude number, Hydraulic jump-locations where hydraulic jump occurs and its use.	
UNIT VI: Hydraulic Pumps	6a	Compare the given types of pumps on given points.	6.1	Pump, types- Centrifugal, Submersible, Vertical Turbine pump, Horizontal Split case.	CO6
	6b	Identify given components of centrifugal pump.	6.2	Centrifugal Pump – Component parts, principle of working, priming of pump, Submersible pump-Component parts & working.	
	6c	Compute power required for a pump under a given situation.	6.3	Heads in pump - Suction head, Delivery head, Static head and Manometric head. Computation of power required for pumps.	
	6d	Select a suitable pump for given conditions.	6.4	Parameters used for Selection choice of pump.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Compute the physical properties of given water, oil and Mercury.	2#	CO1
I	2	Measure pressure at a a point by Piezometers and pressure gauges.	2	CO1
I	3	Measure pressure difference by using U-tube differential Manometer/ Inverted U tube manometer.	2	CO1
II	4	Determine resultant pressure and centre of pressure on immersed laminas, sides of tanks and on dams and canal gates under given conditions.	2#	CO2
III	5	Identify type of flow through a pipe using Reynolds apparatus.	2#	CO3
III	6	Use Bernoulli's Apparatus to verify Bernoullis Theorem and to draw total energy line for flow in a closed conduit of varying cross section.	2	CO3
IV	7	Determine friction factors for pipes of different diameters using Darcy Weisbach equation.	2#	CO4
IV	8	Determine minor losses in pipeline for (any one) 1. Sudden contraction. 2. Sudden expansion 3. Bend and elbows.	2#	CO4
IV	9	Calibrate Venturimeter to find out discharge through pipe.	2#	CO4
IV	10	Calibrate an Orifice to find out discharge through tank.	2#	CO4
V	11	Calibrate a Triangular notch to find out discharge through channel.	2#	CO5
V	12	Measure the velocity of flow through channel using a current meter.	2#	CO5
V	13	Measure the velocity of flow through channel using Pitot tube.	2#	CO5
VI	14	Determine the efficiency of a given centrifugal pump.	2#	CO6

VI	15	Identify parts of centrifugal pumps. Collect information brouchers of any make of centrifugal/submersible/ V. T. pump.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect information regarding physical properties of common fluids like water, glycerine, mercury, petrol. And compare these fluids on their properties.

2. Prepare list of various pressure measuring devices. Find the pressure measuring device used to measure tyre pressure.

3. Prepare the list of cases in civil engineering structures where hydrostatic pressure and its point of application need to be determined.

4. Collect different types of problems in Hydrostatics and solve them.

5. List your surrounding situations where 1. gravity 2. pressure flow occurs and prepare the detailed report.

6. Prepare a List of factors which contributes to pressure drop in pipe.

7. Collect information regarding coefficient of friction in pipes of different diameters and different materials.

8. Collect information brouchers of various pipe materials and pipe fittings available in market.

9. Prepare a small model of channel with an arrangement of rectangular / triangular notch.

10. Collect information brouchers of various types of pumps available in market / internet resources.

11. Determine the power of pump required at your any residential multi-storeyed building in your vicinity.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Physical properties of fluids and Pressure Measurement	5	C	02	04	04	10
			O	00	04	00	4
2	Hydrostatics	7	C	02	04	06	12
			O	00	04	00	4
3	Fundamentals of fluid flow	7	C	02	04	06	12
			O	00	04	04	8
4	Flow through pipes and tanks	10	C	02	04	10	16
			O	02	00	06	8
5	Flow through open channels	10	C	02	04	06	12
			O	00	04	04	8
6	Hydraulic Pumps	6	C	00	04	04	8
			O	02	00	06	8
Total		45	C	10	24	36	70
			O	4	16	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	5R2	6R2	4R2	5	7
2	1U4	1U4	2U4	2U4	3U4			3	5
3	3U4	4U4	5U4	5U4	6U4			3	5
4	1A4	3A4	4A4	5A4	6A4			3	5
5	2U6	3A6	4A6					2	3
6	4A6	5A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of equipment & Drawing diagram of Experimental Set Up.	5
2	Performance	10
3	Calculation, Result Conclusion, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of topic	5
2	Performance	10
3	Report Writing	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	-
CO4	3	3	-	3	-	-	-	2	-
CO5	3	3	-	3	-	-	-	2	-
CO6	3	-	-	-	-	-	-	2	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Hydraulics and Fluid Mechanics including Hydraulics Machines	P. N.Modi & S. M. Seth, Standard Book House, 18th Edition, 2011	10:8189401269
2	Fluid Mechanics and Hydraulics	Jagdish Lal, Metropolitan book co. Pvt. Ltd., 9th Edition 2008	10:8120004221
3	Fluid Mechanics and Hydraulic Machines	R. K.Bansal, Laxmi publication New Delhi, , 9th Edition 2015	10: 8131806618
4	Fluid Mechanics & Hydraulic Machines	R.K. Rajput, S . Chand Publisher, 5th Edition 2014	10: 8121916666
5	Hydraulics, Fluid Mechanics and Fluid machines	S. Ramamrutham, Dhanpat Rai and Sons, Delhi, 1st Edition 2006	10: 8187433841
6	Hydraulics, Fluid Mechanics and fluid machines	R. S. Khurmi, S. Chand Publisher, 19th Edition 2007	10: 8121901626
7	Hydraulic Machines	D. P. Kothari, V. V. Ambade and G. K. Awari, New Age International Publishers, New Delhi, 1st Edition 2016	10: 9789388818193

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XVI List of Major Equipment/Machineries with Specification:

1. Hydraulic Bench with set up for Bernaullis Experiment, Frictional Losses, Venturimeter
2. Hydraulic Bench with set up for Orifice
3. Hydraulic Bench with set up for Notches
4. Reynolds Experimental set Up
5. U Tube manometers
6. Measuring Tanks
7. Centrifugal, and Submersible Pumps

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. W. Pawde	HOD, Civil Engineering	Government Polytechnic, Nagpur
2	Dr. D. K. Parbat	HOD, Civil Engineering	Government Polytechnic, Nagpur
3	Dr. D.N. Kongre	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	Retd. Superintending Engineer	Public Works Department, Govt. of Maharashtra
5	Dr. Abhay Shende	Principal	JL Priyadarshni College, Nagpur
6	Dr. V.G. Kondekar	HoD, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSE
Course Code	:	CE302H
Course Title	:	Solid Waste Management

I Rationale:

Industrialization and Urbanization is increasing day by day. As a result of this the generation of solid waste is a major problem all over the country within the urban as well as rural area. Recommend suitable method of disposal of solid waste with economy and acceptable environmental constraints including reuse and recycle, wherever applicable. Content on other types of solid waste such as biomedical waste, Construction waste, E waste and plastic waste will be useful in deciding appropriate method for collection, transportation and safe disposal of these wastes in the land. student capable of addressing comlplex challenges associated with the solid waste in environmentally suitanable,economically viable and socially responsible manner.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Prepare Solid Waste Management plan for City or Town

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** various types of solid waste produced with their characteristics

CO2: **Enumerate** different methods of collection, transportation and disposal of solid waste

CO3: **Select** suitable method of disposal of solid waste

CO4: **Identify** Bio medical waste, E-waste and Industrial waste

CO5: **Identify** health aspects at various stages of handling & processing of solid waste

CO6: **Suggest** suitable method of recycling and reuse of solid waste

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Solid waste	1a	Classify given types of solid wastes.	1.1	Definition of solid waste& different types of solid waste –Domestic waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E waste, hazardous waste, institutional waste.	CO1
	1b	Differentiate given types of waste.	1.2	Sources of solid waste & Classification of solid waste – hazardous and non-hazardous waste.	
	1c	Analysis given characteristics of solid waste.	1.3	Physical and Chemical characteristics of Solid Waste. Quartering technique.	
	1d	Identify the impact of solid waste on environment .	1.4	Impact of solid waste on environment. Solid waste management techniques – solid waste management Hierarchy, waste prevention and waste reduction.	
	1e	Identify given factors affecting generation of solid waste .	1.5	Factors affecting generation solid waste.	

UNIT II: Storage, Collection and Transportation of Municipal Solid Waste.	2a	Classify given methods of collection of municipal Solid waste.	2.1	Methods of Storage & Collection of Municipal Solid Waste (MSW).	CO2
	2b	Identify given tools & equipments used for collection of solid waste.	2.2	Tools and Equipments – Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community Bin like movable and stationary Bin.	
	2c	Use given solid waste transportation vehicles.	2.3	Transportation of municipal Solid waste Transportation vehicles with their capacity and working-Animal carts,Auto vehicles, Tractors or Trailers,Trucks, Dumper, Compactor vehicles.	
	2d	identify the necessity & location of transfer station of the Solid Waste	2.4	Transfer station- meaning, necessity, location of the Solid Waste	
	2e	Interprete given Flow diagram of solid waste management plan for city.	2.5	Flow diagram of solid waste management plan for city.	
Disposal of Solid Waste	3a	Compare given composting methods.	3.1	Composting of waste principle, factor & methods of Composting Manual Composting – Bangalore method, Indore Method & Dano process.	CO3
	3b	Analyse given methods of composting of solid waste waste.	3.2	Land filling technique - Factors for site Selection, Land filling methods- Area method, Trench method and Ramp method, Vermicomposting	
	3c	Compare given landfill methods.	3.3	Leachate and its control, Biogas from landfill, Advantages and Disadvantages of landfill method.	

UNIT III:	3d	Identify the given process of incineration of solid waste .	3.4	Incineration of waste - Introduction of incineration process, Types of incinerators- Multiple chamber incinerators and Municipal incinerators.	
	3e	Compare given process.	3.5	Products of incineration process with their use Pyrolysis of waste –Definition, methods, Advantages and Dis–advantages of incineration process.	
UNIT IV: Special Types of Solid Wastes	4a	Select the sources of generation of biomedical waste.	4.1	Biomedical Waste -Definition & Sources of Biomedical Waste generation. Composition and categories of biomedical waste.	CO4
	4b	Evaluate bio-medical waste management Technique	4.2	Salient features of Biomedical Waste Management rule 2016.	
	4c	Classify given E-waste and recycled the E-waste.	4.3	E- waste: Defination and classification , Impacts of E-waste on environment & Public health, Disposal and Recycling of E- waste.	
	4d	Classify given industrial waste.	4.4	Industrial waste: classification of industrial waste, Collection & disposal of industrial waste. Recycling and Reuse of industrial waste.	
UNIT V: Health aspect and public Involvement	5a	Identify health aspects at given stages of handling.	5.1	Health aspects during handling and segregation of solid waste.	CO5
	5b	Identify health aspects at given stages processing of solid waste.	5.2	Health aspects during processing and recycling of solid waste	
	5c	Educate the people regarding effective solid waste management.	5.3	Public awareness and involvement in solid waste management. Protective measures used.	

UNIT VI: Recycling of Solid Waste	6a	Elaborate the purpose and benefits of recycling of solid waste.	6.1	solid waste recycling:purpose and Benefits	CO6
	6b	Identify the given method of collecting recyclables.	6.2	Methods of collecting recyclables from solid waste and Solid waste recycling potential in India	
	6c	Prepare a plan for integrated solid waste management for given situation.	6.3	Intrgrated solid waste management plan	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare visit report on solid waste disposal plant nearby city.	2#	CO1
II	2	Prepare visit report on composting plant.	2#	CO2
II	3	Prepare a report on collection, storage, transportation and disposal of MSW in your locality.	2#	CO2
III	4	Prepare a report on sanitary landill by visiting nearby landfill site.	2	CO3
III	5	Prepare visit report on Biogas plant.	2#	CO3
III	6	Prepare visit report on vermin composting plant.	2#	CO3
IV	7	Prepare visit report on biomedical waste treatment plant-Part-I	2#	CO4
IV	8	Prepare visit report on biomedical waste treatment plant-Part-2	2#	CO4
V	9	Collect information of various machinery used for collection and transportation of solid waste.	2	CO5
V	10	Prepare report on health aspect during handling and transportation of solid waste-Part-I.	2#	CO5
VI	11	Prepare report on health aspect during handling and transportation of solid waste-Part-II.	2#	CO6
VI	12	Prepare visit report on Centralised transfer station.	2	CO6
VI	13	Prepare report on solid waste management plan of the Ciity-Part-I(Genration,Segration).	2#	CO6
VI	14	Prepare report on organization pattern of solid waste management- Part-Ii(safe Disposal Treatment).	2#	CO6
VI	15	Prepare an integrated solid waste management plan for any city.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Conduct a solid waste segretion audit nearby your home and suggest treatment on it and prepare a report.
2. Set up a small Composting unit at your home and prepare a report.
3. Evaluate the types and quantity of solid waste generated in your home and prepare woking model.
4. Create an educational campaign on waste management and prepare report.
5. Conduct a solid waste Generation audit of nearby multi-speciality Hospital nearby your locality and prepare report.
6. Use the proper methods at your home for disposal Electronic waste and prepare the report.
7. Prepare the action plan of landfill on environment in your area and prepare a report on it.
8. Develop a waste reduction strategy for your nearby locality.
9. Conduct a Survey to understand waste management practices in your community.
10. Prepare intigrated solid waste management plan for any cityand submit the report.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Solid waste	6	C	04	04	00	8
			O	00	04	00	4
2	Storage, Collection and Transportation of Municipal Solid Waste.	10	C	02	04	12	18
			O	00	04	06	10
3	Disposal of Solid Waste	8	C	02	04	6	12
			O	02	00	06	8
4	Special Types of Solid Wastes	4	C	02	00	04	6
			O	00	04	00	4
5	Health aspect and public Involvement in solid waste management	8	C	00	08	04	12
			O	02	00	04	6
6	Recycling of Solid Waste	9	C	04	04	06	14
			O	04	04	00	8
Total		45	C	14	24	32	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	2R2	3R2	4R2	3R2	5R2	5	7
2	1U4	2U4	3U4	1U4	2U4			3	5
3	4A4	5U4	5U4	4U4	5A4			3	5
4	5A4	6R4	6U4	6R4	6U4			3	5
5	2A6	2A6	2A6					2	3
6	3A6	6A6	3A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Procedure	5
2	Drawings diagram of object	5
3	Report Writing	10
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of Topic	5
2	Performance	5
3	Report Writting	10
4	Timely Submission	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	-	-				
CO2	3	-	-	-	-				
CO3	3	3	-	-	2		2	2	
CO4	3	-	-	-	-		-	2	
CO5	3	3	-	-	2		2	-	
CO6	3	3	-	-	2		2	2	

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Solid Waste Management	S.K.Garg Khanna Publication	13:978-8174092304
2	Municipal Solid Waste Management in Developing Countries	Sunil kumar	13:978-036757484
3	Solid Waste Management	Bhide, A. D.,National Scientific Documentation Centre, New Delhi	---------
4	Manual on Municipal Solid Waste Management	Central Public Health and Environmental Engineering Organization	--------

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2. www.tnu.edu.vn/sites/quynhntt/references/8064517-Environmental-Engineering.pdf accessed on 16 th August, 2024
3. bookboon.com/en/environmental-engineering-ebooks accessed on 16 th August,2024
4. https://www.engr.udel.edu/downloads/UndergradEnvironmental.pdf accessed on 16th August, 2024
5. https://www.youtube.com/watch?v=syn4lUvF3YE accessed on 16 th August,2024
6. https://www.youtube.com/watch?v=yZJbgimr5hg accessed on 16 th August,2024

XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. W. Pawde	HOD,Civil Engineering	Government Polytechnic, Nagpur
2	Mr. N.U.Sulbhewar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mr. V.B.Dhait	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er.G. B. Takey	EE. Vigilance & Quality Control	Public Works Department,Nagpur
5	Dr.Abhay Shende	Principal	JL Priyadarshni College,Nagpur
6	Dr.V.G. Kondekar	Head, civil Engineering	Government Polytechnic,Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSE
Course Code	:	CE303H
Course Title	:	Advanced Building Services

I Rationale:

Building services ensure functionality, comfort, safety, and efficiency in modern buildings. They provide essential systems like HVAC, plumbing, electrical, and fire protection, enhancing indoor environments and occupant well-being. Integrating energy management and renewable energy systems reduces operational costs and environmental impact. Compliance with building codes ensures safety and legality. Overall, building services are crucial for creating sustainable, adaptable, and user-friendly spaces that meet the needs of occupants and improve building value.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Manage effectively various Builoding Services

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** various building services required in residential, public and commercial buildings in synopsis sentence**.**

CO2: **Evaluate** building Automation, ventilation and air filtration systems**.**

CO3: **Implement** fire protection standards and regulations for high-rise buildings.

CO4: **Prepare** suitable plumbing system for given type of building**.**

CO5: **Suggest** the feasibility and effectiveness of implementing rainwater harvesting and solar water heating systems in a building.

CO6: **Evaluate** the relevant system of lighting, ventilation and acoustics for any building**.**

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
70	30	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Overview of buiding services	1a	Cassify buildings according to the National Building Code.	1.1	Introduction to building services, Classification of buildings as per National Building code, Necessity of building services, Functional requirements of building, Different types of building services i.e. HVAC (Heat, Ventilation and Air Conditioning), Escalators and lifts, fire safety, protection and control, plumbing services, rain water harvesting, solar water heating system, lighting, acoustics, sound insulation and electric installation etc.	CO1
	1b	Identify various Building services for given structure	1.2	Role and responsibility of Building Service Engineer, Introduction to BMS (Building Management Services), Role of BMS, concept of smart building	

UNIT II: Building Automation Systems	2a	Select Routine maintainance procedure for Given BAS	2.1	Introduction to Building Automation,Definition and Purpose of Building Automation System (BAS), Benefits of Building Automation, Routine maintenance procedures for BAS.	CO2
	2b	Identify various types of sensors ,control systems & key concepts of smart building technologies.	2.2	Overview of the core components (sensors, controllers, actuators) , Types of Sensors and their integration Control systems and integration, Smart building technologies, Relevant codes and standards for implementing BAS in civil engineering, safety regulations and compliance requirements for Ensuring BAS meets.	
	2c	Evaluate the benefits in enhancing efficiency, sustainability, and occupant experience of given smart building.	2.3	Introduction to smart building technologies and their benefits.	
	2d	Apply various access control systems and methods for given building systems	2.4	Design Principles security systems for buildings, factors for risk assessment and site-specific needs, Integration with Building Layout, Types of Surveillance Systems, Access ontrol Systems, access control systems with building infrastructure, Routine Maintenance	
afety	3a	Select the relevant system of fire safety for the given structure with justification	3.1	Fire protection requirements for multi-storeyed building, causes of fire in building, Fire detecting and various extinguishing systems, Working principles of various fire protection systems.	

UNIT III: Fire Sa	3b	Analyze fire safety measures for given residential and multi-storeyed public buildings	3.2	Safety against fire in residential and public buildings (multi-storeyed building), National Building Code provision for fire safety, Fire resisting materials and their properties, Fire resistant construction, procedures for carrying out fire safety inspections of existing buildings, Provisions for evacuation	CO3
UNIT IV: Plumbing Engineering	4a	Interprete AHJ (Authority Having Jurisdiction) approval in laying public System.	4.1	Importance of plumbing, AHJ (Authority Having Jurisdiction) approval, Plumbing Terminology and fixtures: Terms used in plumbing, Different types of plumbing fixtures,shapes/sizes, capacities, situation and usage, Traps, Interceptors	CO4
	4b	Identify various systems of plumbing & plumbing arrangement for given high rise buildings.	4.2	System of plumbing for building water supply: storage of water, hot and cold water supply system.	
	4c	Suggest suitable type of valve at given location in pipeline	4.3	system, types of Vents and purpose of venting, Concept of grey water and reclaimed water	
	4d	Suggest Relevant Plumbing system for given building with justification	4.4	Different pipe materials, and jointing methods, fittings, hanger, supports and valves used in plumbing and their suitability.	
	5a	Apply given rainwater harvesting methods to design sustainable water management systems.	5.1	Rain water harvesting methods ,Storing rain water for direct use ,Recharging ground water aquifers from roof top runoff , Recharging ground water aquifers with runoff from ground areas , Modular Rain Water Harvesting System	

UNIT V: Sustainable Water and Energy Solutions	5b	Evaluate the components of a rainwater harvesting system for specified applications.	5.2	Components of rain water harvesting , Catchment area , Coarse mesh/leaf screen , Gutter , Down spout/Conduit , First flushing device , Filter, Sand Filter , Charcoal Water Filter , Dewas Filter , Varun , Horizontal roughening filter and slow sand filter ,Rain water Purification Center , Settlement tank , Storage tank , Matching the capacity of the tank with the area of the roof ,Matching the capacity of the tank with the quantity of water required by its users ,Choosing a tank size, appropriate in terms of cost, resources and construction methods	CO5
	5c	Select the relevant Solar water heater system required for the given site condition with justification	5.3	Concept of SWH (Solar water heating), component parts of SWHS, various system of SWH (heat transfer, propulsion, passive direct system, active direct system, Do-it- yourself), SWHS design principles, specification, installation and maintenance, cost effect, energy production, life cycle energy assessment and applications.	

UNIT VI: Lighting, Ventilation and Acoustics	6a	Select relevant system of lighting for the given building with justification.	6.1	Concept of lighting, types of lighting (natural and artificial), factors influencing the brightness of room, factors affecting selection of artificial lighting, installation of light (direct, half-direct, indirect, half-indirect and direct-indirect), types of light control (manual switch, remote switch, timer switch and photo-electric cell switch), types of lamps (incandescent, tungsten halogen and electric discharge), Lamp selection as per room sizes. Conversion from Lumen (unit of measurement indicating the visible light output of a light source) to Lux (the metric system of luminance).	CO6
	6b	Identify different types of ventilation systems	6.2	Concept of ventilation, necessity and typcs of ventilation, Overview of Air Conditioning system for building.	
	6c	Compare Various Accoustic Materials on the basis of various points.	6.3	Building Acoustic, Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator)	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify components of building services available in your institute building and prepare a report.	2#	CO1
II	2	Identify of BAS the components of BAS (Building Automation system), including controllers, sensors, and actuators, and their applications in civil engineering.	2#	CO2
II	3	Prepare a report by Viewing the relevant video of Building Automation System & write a report on it	2#	CO2
III	4	Prepare a report on the specifications and working of the fire extinguisher by viewing the relevant video/simulation/photographs.	2#	CO3
III	5	Prepare a report by Viewing the relevant video/simulation/photographs and then draw a line plan showing the provisions of fire safety system in any multi storied residential building/anyone public building in our locality.	2#	CO3
IV	6	Prepare a report on the layout for the water supply and sanitation system for the bathroom and WC of any multi-storey building including design parameters by viewing the relevant video/ simulation/ photographs.	2	CO4
IV	7	Prepare a report on the layout for the water supply and sanitation system for the bathroom and WC of any local public building including design parameters by viewing the relevant video/model	2#	CO4
IV	8	Identify and handle various pipes (PVC, copper, PEX), fittings, valves, and plumbing tools & their applications in residential and commercial plumbing systems.	2#	CO4
IV	9	Draft a plumbing plan including water supply and drainage systems.	2#	CO4
IV	10	Collect the information of various plumbing codes, ensure designs and installations are compliant, and perform safety checks during and after installation & write a report on it.	2#	CO4

V	11	Design basic rainwater harvesting system & calculate storage capacity and install piping for stormwater drainage.	2#	CO5
V	12	Prepare a report by Studiying the components of a solar water heating system, including solar collectors, storage tanks, circulation pumps, and control systems & write a report on it	2#	CO5
V	13	Prepare a report from Visit to site to determine optimal collector placement based on sun exposure, roof orientation, and shading & write a report on it	2	CO5
VI	14	Analyze and compare energy consumption of different lighting technologies (e.g., LED vs. incandescent), and implement energy-saving measures.	2	CO6
VI	15	Design a ventilation plan, including air intake and exhaust locations, duct sizing, and airflow calculations	2#	CO6

Note # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a sketchbook consisting of components of modern building services (for Sketches which are not included in Practical sketch book).
2. Collect the relevant information of Building Automation system and prepare a report on it.
3. Prepare a report on Building Automation system (BAS) including a case study.
4. Collect the relevant information of different techniques for RWH or SWHS and submit a report on it.
5. Prepare a summary report with reference to lighting, ventilation and acoustic system of a building.
6. Prepare a report on modern Fire Safety, Detection and Protection systems.
7. Conduct Market Survey on Security and Access Control Systems
8. Conduct Market Survey on types of Sensor & prepare a report on it
9. Conduct Market Survey on Fire Safety , detection & protectin system Equipments & prepare a report on it
10. Prepare a Layout Of Rain Water Harvesting System.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Overview of buiding services	2	C	2	4	0	6
			O	2	0	0	2
2	Building Automation Systems	11	C	2	4	10	16
			O	0	4	6	10
3	Fire Safety	8	C	2	4	6	12
			O	0	8	0	8
4	Plumbing Engineering	10	C	0	8	6	14
			O	2	4	4	10
5	Sustainable Water and Energy Solutions	8	C	2	4	10	16
			O	0	4	0	4
6	Lighting, Ventilation and Acoustics	6	C	2	4	0	6
			O	0	0	6	6
Total		45	C	10	28	32	70
			O	4	20	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	5R2	6R2	1R2	4R2	5	7
2	1U4	2U4	3U4	3U4	3U4			3	5
3	4U4	4U4	2A4	4U4	4A4			3	5
4	5A4	5A4	4A4	5U4	6U4			3	5
5	2A6	3A6	2A6					2	3
6	4A6	5A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Preparation of report	5
2	Performance	10
3	Diagram	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Preparation of report	15
2	Performance	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	1	-	-	-	-
CO4	3	-	-	-	-	-	1	-	-
CO5	3	-	-	-	-	-	-	-	1
CO6	3	1	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Plumbing Engineering	S.G,Deolalikar,Jain publishers,2017	13:978-8120345712
2	Fire Engineering	K. K. Sethi,Laxmi Publications, 2006	13:978-8170087490
3	Automation System in Smart & Green Buildings	Er.V.K.Jain, Khanna Publishers,2009	13:978-9332574160

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1. https://youtu.be/fUta3n-L7Co?si=r1WX-U4pAR3EuDa , Assessed on 30/12/24
2. https://youtu.be/_yCllHMvQ_0?si=1No2KLQSJa_cL4N , Assessed on 30/12/24
3. https://youtu.be/27TUmzyL9DI?si=os1ovNTD46ZjeUvq , Assessed on 30/12/24

XVI List of Major Equipment/Machineries with Specification:

1. Model of a civil engineering structure depicting various components.
2. Chart showing detailing of lift, escalator and ramp.
3. Model of various material used in water supply and sanitary drainage.
4. Model of a civil engineering structure depicting various components of Rain Water Harvesting system.
5. Model of a civil engineering structure depicting various components of Solar Water Heating system.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	DR.D.K.Parbat	HOD in Civil Engineering	Government Polytechnic Nagpur
2	N.K.Deshmukh	Lecturer in Civil Engineering	Government Polytechnic Nagpur
3	V.B.DHAIT	Lecturer in Civil Engineering	Government Polytechnic Nagpur
4	Dr.D.K.Kondekar	HOD in Civil Engineering	Government Polytechnic Nagpur
5	Dr.Abhay Shende	HOD in Civil Engineering	Priyadarshini College of Engineering,Nagpur

(Dr.D.K.Parbat)
HOD & Chairman PBOS, CE

(Dr.G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	SEC
Course Code	:	CE351H
Course Title	:	Estimating and Costing

I Rationale:

A civil engineer mainly deals with construction of civil engineering structure. This course enables the students to prepare the estimate for all type civil engineering construction works. In case of unavailability of market rates, they can prepare their own rate analysis and thereby prepare the estimate. Estimating and costing skills are very important for a Civil Engineer for the estimation of project cost. The skills acquired will lead the students as professionals / entrepreneurs in Civil Engineering.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Prepare Estimates required in civil Engineering.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** principle of Estimating and Costing for preparation of Estimates.

CO2: **Prepare** approximate estimates of various Civil Engineering Works.

CO3: **Prepare** detailed estimates of various Civil Engineering Works

CO4: **Compute** rates of various items of Civil Engineering Works.

CO5: **Draft** specifications for various items of Civil Engineering Works.

CO6: **Carry** out the valuation of various civil Engineering Works

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	4	-	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	50	20	50+	20	-	-

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Principle of Estimating	1a	Justify the given terms in Estimating & Costing.	1.1	Definition of Estimating, Costing, Contingencies charges, Work charge establishment charges, Quality control charges, Centage charges, Electrification charges, Water supply and sanitary charges, Prime cost, Provisional sum, Provisional quantities, Lump sum, Extra items, Purpose of Estimating and costing.	CO1
	1b	Distinguish given types of Estimates	1.2	Types of estimates: Approximate Estimate, Detailed Estimates, Revised Estimate, Supplementary estimate, Annual maintenance and repair estimate.	
	1c	Use units & Standard mode of measurments for preparation of Estimates.	1.3	Units and standard modes of measurements for different civil engineering items of works as per I.S. 1200 and P.W.D. Handbook.	

	1d	Apply given rules of deduction for various items of work as per IS-1200 / PWD Handbooks.	1.4	Different civil engineering items of works and rules for deduction as per I.S.1200 & P.W.D. hand books.	
UNIT II: Approximate estimate.	2a	Identify method of estimate to be adopted for given types of civil engineering structures.	2.1	Purpose of preparing approximate estimate. Method, Types & Classification of approximate estimate.	CO2
	2b	Compute Estimates for the given Methods.	2.2	Service unit method, Plinth area method, Cubical content method with Numericals	
UNIT III: Detailed Estimates	3a	Prepare check list of items of given Civil Engineering work.	3.1	Check list of items of small residential building (Load bearing Structure & Framed Structure)	CO3
	3b	Use Specified steps for preparation of detailed estimate.	3.2	Steps in preparing detailed estimate: Measuring the dimension,Squaring the dimension,Abstracting or working up,Billing.	
	3c	Use Various formats generally adopted in estimating.	3.3	Contents of measurement sheets , Abstract sheet & Bar Bending Schedule.	
	3d	Prepare estimates for given Work	3.4	Methods & Procedure for taking out quantities of various items of works for load bearing structure & Framed structure. Methods of earthwork estimate for road and canals with examples.	
	3e	Compute quantities for given item of work	3.5	Calculation of quantities of steel reinforcement with bar bending schedule in R.C.C. members like footings. beams, columns and slabs.	
sis	4a	Identify factors affecting rate analysis.	4.1	Definition of rate analysis with its purpose & importance . Definition of lead and lift, Task work, Schedule of Rates. Major & minor factors affecting rate analysis.	

UNIT IV: Rate Analy	4b	Identify given factors affecting task work and schedule of rates	4.2	Factors affecting task work . Different catogaries of Labour with their prevailing Wages	CO4
	4c	Compute the quantities of materials required for given Civil Engineering Items.	4.3	Working quantities of materials required for different items of Civil Engineering works.	
	4d	Prepare rate analysis for Specified civil engineering works	4.4	Preparing rate analysis for a few common items of civil engineering works such as - PCC , RCC, BB Masonary, Plastering	
UNIT V: Specifications	5a	Enlist points to be observed in drafting the specification of an item	5.1	Defination of Specification,its necessity,Importance& its Purpose.Points to be observed in drafting the specification of civil engineering items	CO5
	5b	Specify Various aspect of specifications	5.2	Legal aspect of specifications. Method of writing specification, Specification paragraph.	
	5c	Distinguish given types of Specifications.	5.3	Types of Specification:Brief Specification,Detailed Specification. Types of Detailed specification.Draft Specification of given items	
UNIT VI: Valuation	6a	Justify given terms used in valuation.	6.1	Defination of following: valuation, cost , price ,value, Book value, scrap value, salvage value, speculative value, distress value, market value, sentimental value, monopoly value, Depreciation, obsolescence, sinking fund,capitalized value, Gross income, Net income, Year purchase,outgoings.	CO6
	6b	calculate Depreciation using given methods	6.2	Methods of calculation of depreciation – straight line method, sinking fund method, constant percentage method.	
	6c	Compute Capitalized Value of Civil Engineering Items / Work.	6.3	Computation of capitalized value.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare a sheet by considering % of Contingencies charges,Work charge establishment charges, Quality control charges, Centage charges, Electrification charges, Water supply and sanitary charges.	2	CO1
II	2	Prepare approximate Estimate for 1 Km length Railway Project.	2#	CO2
III	3	Prepare a check list of items of the following types of civil engineering works:Load Bearing type Building (Ground Floor only)	2	CO3
III	4	Prepare a check list of items of the following types of civil engineering works:Framed structure type Building (Ground Floor only)	2#	CO3
III	5	Prepare a check list of items of the following types of civil engineering works: Water Bound Macadam Road, Septic tank or Community well, Canal Earthwork.	2	CO3
III	6	Prepare a check list of items of the following types of civil engineering works:Hume pipe culvert or slab culvert, Percolation Tank.	2	CO3
III	7	Prepare detailed estimate of a load bearing structure of single storied residential building for all items of works. (Part-I)	2#	CO3
III	8	Prepare detailed estimate of a load bearing structure of single storied residential building for all items of works. (Part-II)	2#	CO3
III	9	Prepare detailed estimate of a load bearing structure of single storied residential building for all items of works. (Part-III)	2#	CO3
III	10	Prepare detailed estimate of a load bearing structure of single storied residential building for all items of works. (Part-IV)	2#	CO3
III	11	Prepare detailed estimate of R.C.C. single storied residential building for all items of work. (Part-I)	2#	CO3

III	12	Prepare detailed estimate of R.C.C. single storied residential building for all items of work (Part-II)	2#	CO3
III	13	Prepare detailed estimate of R.C.C. single storied residential building for all items of work (Part-III)	2#	CO3
III	14	Prepare detailed estimate of R.C.C. single storied residential building for all items of work. (Part-IV)	2#	CO3
III	15	Prepare the estimate of small R.C.C. hall by considering concrete for footing, columns, beams and slabs.	2#	CO3
III	16	Prepare the estimate of small R.C.C. hall by considering concrete for footing, columns, beams and slabs.	2#	CO3
III	17	Prepare the estimate of small R.C.C. hall by considering quantity of steel reinforcement. (Part-I)	2#	CO3
III	18	Prepare the estimate of small R.C.C. hall by considering quantity of steel reinforcement. (Part-II)	2#	CO3
III	19	Prepare detailed estimate of road for Major district Road for 1 Km length. (Part-I)	2#	CO3
III	20	Prepare detailed estimate of road for Major district Road for 1 Km length. (Part-II)	2#	CO3
III	21	Prepare detailed estimate of road for National Highway for 1 Km length. (Part-I)	2#	CO3
III	22	Prepare detailed estimate of road for National Highway for 1 Km length. (Part-II)	2#	CO3
III	23	Prepare detailed estimate for the following:Septic tank ,community well	2#	CO3
III	24	Prepare detailed estimate for the following:Hume pipe culvert or slab culvert	2#	CO3
IV	25	Prepare rate analysis of following items of works for building work: IInd class B.B. masonry in C.M. 1:6,12 mm thick cement Plaster in C.M – 1:5	2#	CO4
IV	26	Prepare rate analysis for building work: R.C.C. mix for e.g. M20 excluding reinforcement	2	CO4
V	27	Draft a specification for following items of works: IInd class B.B. masonry in C.M. 1:6 ,Coursed or Uncoursed rubble masonry in C.M. 1:6. (Part-I)	2	CO5

V	28	Draft a specification for following items of works:12 mm thick cement Plaster in C.M. 1:5, Reinforced Cement Concrete mix. e.g. M20.(Part-II)	2#	CO5
VI	29	Determine the valuation of structure and submit the valuation report in specific Format. (Part-I)	2#	CO6
VI	30	Determine the valuation of structure and submit the valuation report in specific Format. (Part-II)	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Principle of Estimating	2	C	0	0	0	0
			O	0	0	0	0
2	Approximate estimate.	2	C	0	0	0	0
			O	0	0	0	0
3	Detailed Estimates	13	C	0	0	0	0
			O	0	0	0	0
4	Rate Analysis	6	C	0	0	0	0
			O	0	0	0	0
5	Specifications	3	C	0	0	0	0
			O	0	0	0	0
6	Valuation	4	C	0	0	0	0
			O	0	0	0	0
Total		30	C	0	0	0	0
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

-----NA-----

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Work out quantity of the item	10
2	Compute rate of engineering item.	20
3	Draft specification for given civil engineering item.	10
4	Viva Voce	10
	TOTAL	50

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	3	-	-	-	-
CO4	3	-	-	-	3	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Estimating and Costing in Civil Engineering	B.N. Dutta,UBS Publishers' Distributors Ltd., 2012	13:9788174767295
2	Estimating, Costing, specification & Valuation	M. Chakraborty, M. Chakraborty Publishers, 2006	13:978-8185304366
3	Estimating, Costing And Valuation	S. C. Rangwala,Charotar Publication House, 2015	13:9788185594859
4	Textbook of Estimating and Costing(Civil Engineering)	G. S Birdie, Dhanpat Rai & Sons, 2015	13:9789384378134
5	Estimating Contract & accounts Vol -I	B. S. Patil, Orient Longman Limited, 1998	13:9788125002154

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2. https://law.resource.org/1200, assessed on 8th September 2023.
3. www.google.co.in/search?q=1.%09cpwd.gov.in%2FPublication%2FSpecs200, assessed on 8th September 2022.
4. www.standardsbis.in/Gemini/search/Browse.action?saleModeName=HARD_COPY&subDivisionId=92, assessed on 8th September 2022.

XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. W. Pawde	HOD,Civil Engineering	Government Polytechnic, Nagpur
2	Mr. N.U.Sulbhewar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mr. V.B.Dhait	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er.G. B. Takey	EE. Vigilance & Quality Control	Public Works Department,Nagpur
5	Dr.Abhay Shende	Principal	JL Priyadarshni College,Nagpur
6	Dr.V.G. Kondekar	Head, civil Engineering	Government Polytechnic,Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	DIPLOMA IN AE/ME/PK/EC/MC/CM/IT/AI/MT/TX/EE
Course Category	:	INP
Course Code	:	IN301H
Course Title	:	Industrial Management

I Rationale:

Diploma level students works at middle management level in the industries.Therefore he has to be proficient in planning, organizing & coordinating various activities of industries s/ organizations or when he is required to work in different types of projects. They are also expected to deal with workforce and management problems. In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. This course aims to deal effectively at superwisory level.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of management.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Analyze** management concepts, organizational structures, functions, principles, and levels for effective decision-making.

CO2: **Analyze** financial sources, capital types, break-even point, and EOQ effectively.

CO3: **Apply** Human Resource Management functions, safety practices, supervision techniques, and industrial acts effectively.

CO4: **Determine** product costs, selling price, depreciation, and financial statements effectively.

CO5: **Apply** quality control techniques, TQM, and ISO standards to ensure quality management and improvement.

CO6: **Apply** the principle of project management, Project Planning and Scheduling.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	--	--	--	2	1

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	--	--	--	--	--	--

**Online Objective Types

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Management	1a	Campare the concept and principles of management.administration & form of ownership.	1.1	Definitions: Management, Organization, Administration and Entrepreneurship. Forms of ownership: Proprietorship, Partnership, Joint stock company.	CO1
	1b	Select suitable forms of ownership & its limitation	1.2	Co-operative sector, Public sector, Government Undertaking, Advantages, Limitations & Application of each type, comparison between different forms.	
	1c	Compare given types of organizations.	1.3	Types of Organization: Line, Functional, line & staff organization, Advantages, limitations & Applications of each type, comparison between different types.	
	1d	Apply the principles of management and functions of management.	1.4	Functions of Management: Forecasting, Planning, Organizing, Directing, Motivating, Controlling, Coordinating, Decision making.	

	1e	Apply the level of management.	1.5	Principles of management, Levels of management and its Function.	
UNIT II: Financial Management	2a	Select suitable finance mode for a given venture.	2.1	Need of Finance and Sources of finance for enterprises - Short term,Medium term and long term sources.	CO2
	2b	Compare the share and debentures on given factors.	2.2	Shares, debentures, types of shares and Comparison between shares & debentures.	
	2c	Calculate Economic Order Quantity (E.O.Q.) based on given data.	2.3	Break Even Analysis, Importance of Break even point, E.O.Q.(Numerical on EOQ).	
	2d	Identify the types of capital use for organisation.	2.4	Types of capital: fixed and working capital, fix deposites.	
UNIT III: Human Resource Management	3a	Apply the Human Resourses Management for organisation.	3.1	Concept, aim, & objectives of Human Resource Management.	CO3
	3b	Apply HRM functions to solve workplace human resource management problems.	3.2	Functions of HRM: planning, organizing, staffing, recruitment, education & training- its need, methods of training, Motivation, controlling,compensation, Labour welfare, Industrial relations.	
	3c	Apply the safety need, causes and its prevention in organisation.	3.3	Safety Engineering: need, organization, committee, programme, instructions & training. Accidents:causes & prevention.	
	3d	Justify the given charecterstic and function of management.	3.4	Characteristics of supervisors, functions of supervisors and styles of supervision & its advantages and limitations.	
	3e	Apply the purpose of the act .	3.5	Industrial act: Need, Factory act 1948, ESI act, Workmen compensation act only	

UNIT IV: Marketing and Inventory Management	4a	Select the Market and apply the Functions,Consumer behavior.	4.1	Definition of Market, Functions of Marketing Department, Marketing strategies, Marketing environment, Consumer behavior.	CO4
	4b	Apply marketing concepts for effective sales forecasting and promotional strategies.	4.2	Market research, Market survey,marketing mix.Sales forecasting, Sales promotion, advertising, media selection.	
	4c	Apply the inventory & inventory control in industries.	4.3	Definition of inventory & inventory control.Types of inventory items in industries, ABC and VED analysis only.	
	4d	Select the Material Cost, Labour Cost and Expenses in Factory	4.4	Product cost determination, Direct Cost and Indirect Cost, Material Cost And Labour Cost, Expenses-Factory and Overheads.Determination of Selling Price of product- Profit and Loss Statement,Balance sheet description.	
	4e	Estimate depreciation.	4.5	Depreciation &, Obsolescence-Concept and Comparison. Methods of Calculating depreciation straightline, reducing balance, annuity, sinking fund & sum of the digit methods. (Simple Numerical)	
UNIT V: Total Quality Management	5a	Apply the concept of quality control and Quality Assurance	5.1	Concept and definition of Quality, Quality Control, Quality Conformance and Quality Assurance	CO5
	5b	Apply the Total quality Management.	5.2	TQM- Concept, Objectives and Process.	
	5c	Suggest the Quality control techniques.	5.3	Quality control techniques: Lean Manufacturing -JIT, 5S”, Six sigma, Kaizen.	
	5d	Compare the Quality Circle and ISO on given points..	5.4	Quality Circle and ISO 9000, ISO14000, ISO 9001: 2015, ISO 14001:2015,	
	5e	Compare ISO and TQM on given points.	5.5	Difference between ISO9000 and TQM.	

UNIT VI: Introduction to Project Management	6a	Justify the Project Management.	6.1	Concept and Definition of Project Management.	CO6
	6b	Suggest the clear project objectives and its scope.	6.2	Project Objectives and its Scope.	
	6c	Apply the project objectives and scope align with project team and stakeholders.	6.3	Defining clear project objectives and scope to align the project team and stakeholders. Managing scope creep and ensuring the project delivers as per the defined scope.	
	6d	Identify the Project Planning.	6.4	Project Planning and ensuring the project delivers as per the defined scope.	
	6e	Select the Scheduling Techniques.	6.5	Introduction to scheduling tools like Gantt charts, Critical Path Method (CPM), and Program Evaluation and Review Technique (PERT). Methods to allocate resources efficiently and track project timelines.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)	Hours	Aligned COs

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Management	5	C	2	4	6	12
			O	0	0	0	0
2	Financial Management	6	C	2	4	8	14
			O	0	0	0	0
3	Human Resource Management	5	C	2	4	6	12
			O	0	0	0	0
4	Marketing and inventory management	6	C	2	4	6	12
			O	0	0	0	0
5	Total Quality Management	4	C	2	4	4	10
			O	0	0	0	0
6	Introduction to Project Management	4	C	2	4	4	10
			O	0	0	0	0
Total		30	C	12	24	34	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q 1 to Q 35	1R2	1U2	1U2	1A2	1A2	1A2	2R2	35/35	
	2U2	2U2	2A2	2A2	2A2	2A2	3R2		
	3U2	3U2	3A2	3A2	3A2	4R2	4U2		
	4U2	4A2	4A2	4A2	5R2	5U2	5U2		
	5A2	5A2	6R2	6U2	6U2	6A2	6A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

NIL

XII Scheme of Self-Learning Summative Assessment (SA):

NIL

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	--	--	--	--	--	3	--	--	--
CO2	--	--	--	--	--	3	---	--	--
CO3	--	--	--	--	--	3	--	--	--
CO4	--	--	--	--	--	3	--	--	--
CO5	--	--	--	--	1	3	--	--	--
CO6	--	--	--	--	--	3	--	--	--

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Industrial Engineering & Management	T.R.Banga & S.C.Sharma, Khanna Publishers,Edition-25,20142	10:81-7409-078-9 13:978-81-7409-078-9
2	Industrial Management	Dr.I.K.Chopde & A.M.Sheikh, S.Chand & Co. Ltd, Delhi, 2nd Edition, 1999	10:81-219-1480-9
3	Industrial Engineering And Management	O.P.Khanna, Dhanpat Rai, New Delhi,1980	10:81-885-9777-5
4	Industrial Engineering: Organization and Management.	Tara Chand, Nem Chand, 5th,1982	10:8185240302
5	Entrepreneurial Development.	S.S. Khanna, S. Chand & Co.Ltd,Delhi,1st,1999, reprint 2006.	10: 81-219-1801-4
6	Industrial Organization and Management	Lawrence L Bethel& James L Riggs, New York, McGraw-Hill,6th,1979	10: 09-322-3849-1

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1. http://www.free-management-ebooks.com/index.htm, accessed on 18th December 2024
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3. https://www.youtube.com/watch?v=2Ie9uH9ySpo&ab_channel=Management
4. youtube.com/watch?v=9QM-3LMeBQA accessed on 18th December 2024

XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Shri.Anil R. Umale	HOD, Mechanical Engineering Shift I	Government Polytechnic, Nagpur
2	shri.A.A.Jagdale	HOD, Mechanical Engineering Shift II	Government Polytechnic, Nagpur
3	Shri.N.J.Burbure	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
4	Dr.Narendra Pawar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
5	Shri.G.H.Dahole	I/C HOD, Mechanical Engineering	Government Polytechnic, Gondia
6	Shri.G.F.Potbhare	Principal	NIT Polytechnic Nagpur
7	Shri.A.R.Shaikh	Director	A.R.Automation. Jafer Nager Nagpur

(Shri. Anil Umale)
HOD & Chairman PBOS, ME

(Dr. G. V. Gotmare)
Member Secretary PBOS, ME

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AE/MT/ PK/TX/TR/AI/MK
Course Category	:	VEC
Course Code	:	VE351H
Course Title	:	Indian Constitution

I Rationale:

This course aims to equip students with practical skills and knowledge necessary for promoting constitutional morality in engineering practices and in society as a whole. The focus will be on hands-on activities, real-Indian applications, and practical projects that address key areas of Indian Constitution.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use constitutional provisions in society.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Narret** the history of Indian Constitution.

CO2: **Illustrate** the Phylosophy of Indian Constitution.

CO3: **Represent** the significance of fundamental rights and duties in day to day life.

CO4: **Demonstrate** the importance of directive principles of state policy in governance.

CO5: **Illustrate** the functioning of constitutional institutions like legislatice, executive, judiciary and media.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	-	2	1

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	-	-

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare a report on history of making of Indian constitution including montague chelmsford reform, Govt. of India Act 1919, The Southborough Committee, The Simon Commission and Neharu Constitutional committee.	2#	CO1
I	2	Prepare a report on Round Table Conferences, 1935 Act, Cripps Mission 1942, Simla Conference 1945, Cabinet mission 1946, Interim Government 1946, The Indian Independence Act of 1947.	2	CO1
I	3	Prepare a report on parts, Total Articles, Total schedules of Indian Constitution and Total ammendments till date.	2#	CO1
I	4	Summerize Dr. B. R. Ambedkar's Speech in Constitution Assembly on 25th November 1949.	2#	CO1
II	5	Recite the preamble of the Indian Constitution at the time of starting of every assembly in laboratory / class room.	2#	CO2
II	6	Prepare a report on Phylosophy of preamble of Indian Constitution.	2#	CO2
II	7	Prepare a report by reading the definition, vision and importance of Indian Constitution.	2	CO2

II	8	Summerize the Article 1 of Indian Constitution.	2#	CO2
III	9	Prepare a report by reading the Fundamental rights mentioned in Indian Constitution.	2#	CO3
III	10	Prepare a report by reading the Fundamental duties mentioned in Indian Constitution.	2#	CO3
III	11	Prepare a report by reading Legal and Constitutional rights mentioned in Indian Constitution.	2	CO3
IV	12	Illustrate the meaning, importance and significance of Directive Principles of State Policy in Indian Constitution.	2#	CO4
IV	13	Summerize various institutions of Indian Constitution.	2#	CO4
IV	14	Prepare a report on Union and state legislature; Judiciary; Election Commission of India; Human Right Commissions.	2#	CO4
V	15	Prepare a report on the pillers of Indian Constitution and Constitutional morality.	2#	CO5
V	16	Prepare a report on the procedure of ammendment in Indian Constitution.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Prepare report / case study	5
2	Performance / Observation	10
3	Results and Discussions (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	-	3	3	-	-
CO2	-	-	-	-	3	3	3	-	-
CO3	-	-	-	-	3	3	3	-	-
CO4	-	-	-	-	3	3	3	-	-
CO5	-	-	-	-	3	3	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	The Constitution of India 2024 (English Version)	Legislative Department	
2	The Constitution of India (paperback)	Delhi Book Market	
3	Bhartache Samvidhan (Marathi)	Pradeep Gaikwad	
4	The Constitution of India	Dr. B. R. Ambedkar	13: 978-8119660384
5	The Constitution of India (Coat Pocket Edition)	Gopal Sankaranarayanan Eastern Book Company	13: 9788119868438

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XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	Head, Civil Engineering	Government Polytechnic, Nagpur
2	Dr. G. V. Gotmare	Head, Electrical Engineering	Government Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur.
6	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AE/MT/PK/TX/MK/AI
Course Category	:	INP
Course Code	:	IN351H
Course Title	:	Internship (Seminar)

I Rationale:

The internship course is a critical component of the diploma program, providing students with hands-on experience in a real-world industry setting. The internship takes place after the fourth semester during summer vacation and involves working in a small, medium, or large-scale industry related to the student's field of study. The course is designed to bridge the gap between academic learning and industrial application, allowing students to apply theoretical knowledge in a practical environment. For ease, assessment this course is devided into two semester, semimar assessment in fifth semester and report writing in sixth semester.

The seminar presentation component of the internship course enables students to develop and refine their communication skills by presenting their internship experience to peers and faculty. This part of the course focuses on the student's ability to articulate the work they performed, the skills they acquired, and the knowledge they gained during their internship. It also emphasizes the importance of clear and effective communication, which is essential in the professional world.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Bridge theoretical knowledge with practical experience in a professional environment.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Evaluate** the organization's structure, processes, safety protocols, and industry standards to determine operational effectiveness.

CO2: **Apply** industry-specific tools, technologies, and skills to perform various operations.

CO3: **Contribute** to organizational goals by handling projects/ tasks under mentor guidance, applying learned skills.

CO4: **Analyze** technical challenges, addressing industry-specific issues effectively.

CO5: **Create** a structured presentation, ensuring accuracy and clarity.

CO6: **Deliver** presentation using visual aids and effective communication.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	10	12	6

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	-	-	25	10	50	20

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)	Topics and Sub-topics	Aligned Cos

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Learn the organization's structure, operational workflow, safety standards, industry practices, methodologies, technologies, and workplace processes to analyze operational efficiency and compliance requirements.	30#	CO1
II	2	Undergo training on industry-specific tools, technologies, and software, while gaining hands-on experience in performing basic operations, troubleshooting, and maintenance tasks, applying relevant skills to real-world industry scenarios and challenges.	60#	CO2
III	3	Participate in daily operations under mentor guidance, handling assigned projects or tasks aligned with industry needs, applying learned skills to contribute to organizational goals and gaining practical experience in real-world scenarios.	150#	CO3

IV	4	Identify and analyze technical challenges in industry, and address industry-specific issues (if any).	60#	CO4
V	5	Prepare a PowerPoint presentation on internship learnings, create and share a structured seminar outline, review technical documents, and practice presentations with peers to ensure accuracy, relevance, and logical flow.	20#	CO5
VI	6	Design slides with visual aids, practice body language, record and refine voice modulation, participate in mock Question & Answer sessions, and deliver the final presentation incorporating feedback for clarity and engagement.	10#	CO6

Note: # Compulsory. Unit No. I to IV during summer vacation in industry and Unit No. V and VI during Fifth Sem.

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. During the summer vacations, after the 4th Semester, students are required to undergo internship with industry/ NGO"s/ Government organizations/ Micro/ Small/ Medium enterprises to make ready for the industry.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Preperation of Presentation	10
2	Presentation Skills	10
3	Question and Answers	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of industry	5
2	Work done and Feasibility of work	25
3	Daily diary and supervisor remark	10
4	Problem identification	10
	TOTAL	50

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	3	3	3	-	-
CO5	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	3	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Industrial Training and Education	Lokesh Choudhary, Mittal Publications, 2007	10: 8183242367 13: 9788183242363
2	Training Practice	Penny Hackett, McGraw-Hill Education, September 2003	10: 0852929803 13: 9780852929803
3	AICTE Internship Policy: Guidelines & Procedures	All India council of Technical Education New Delhi	-

XV e-References:

1. https://internship.aicte-india.org/ assessed on 23rd April 2024
2. https://www.coursera.org/articles/computer-science-internships assessed on 23rd April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Desktop computers
2. Laser Printer
3. DLP

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. P. Mogre	Principal	Government Polytechnic, Nagpur
2	Dr. M. V. Sarode	HoD, Computer Engineering and I/C. Trainining & Placement Officer	Government Polytechnic, Nagpur
3	Dr. G. V. Gotmare	I/C. Curricullum Development Cell	Government Polytechnic, Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

GE Courses

Sem: V

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COURSE CURRICULUM

Program	:	Diploma in ME/EE/EC/IT/MT/TX/AE/PK/CM/MK/AI
Course Category	:	GE
Course Code	:	CE391H
Course Title	:	Building Services

I Rationale:

This Course is designed for other programmes Students under NEP guidelines because it is necessary for the students to understand the basic principles of building services.Building services like water supply, sanitary services, rain water harvesting, elevators and fire protection systems form an essential part of every residential and commercial building. No building can be put into effective use without these services. Also now days the eco friendly design of these systems are on demand. It is necessary for the students to understand the basic principles of building services.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Manage effectively Various building services.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** various types of building services required

CO2: **Design** the various building services like water supply, Building drainage, rain water harvesting.

CO3: **Identify** types of tools and accessories required to design plumbing and sanitary services**.**

CO4: **Identify** various installation services like fire fighting extinguisher, elevators.

CO5: **Evaluate** green building criteria for sustainable building practices

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objetive type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Building Services	1a	Identify given types of building services.	1.1	Definitions of building services, Objective and usesof services, Applications of services for different types building.	CO1
	1b	Select given building services for specific need.	1.2	Classification of building services, Types of services and selection of building services.	
	1c	Compare natural and mechanical ventilation on given points .	1.3	Distinguish natural and mechanical ventilation, Necessity of Ventilation, Types – Natural and Mechanical Factors to be considered in the design.	
	2a	Classify given types of systems.	2.1	Sanitary appurtenances - Classification of fixtures (ablution fixtures and Soil fixtures), bathroom accessories & fitting	

UNIT II: water & waste water	2b	Identify given type of fitting.	2.2	Building Drainage- General principles governing building drainage, Nature of drainage phenomenon, Various plumbing systems (one pipe,two pipe, single stack single tack partially ventilated and hybrid), Capacity and sizing of pipes (primary & secondary braches), Siphonic action & vent piping, Traps for appliances-Bottle trap, Nahani trap, Gulley trap, Air admittance valve, installation of pipes	CO2
	2c	Compare the various water recycling method.	2.3	Recycling of water- need & its usesses & types-storm water, Residential, Industrial & commecial, Grey water.	
	2d	Suggest the use of recycled water.	2.4	Environmental Benefits of recycled water, future of water	
	2e	Justify the concept of Zero Liquid Discharge (ZLD) in industrial plants.	2.5	Recycling of waste water need & uses ZLD – Concept of Zero Liquid Discharge for industrial plant.	
and Communication Services	3a	Identify the design considerations for pipe systems.	3.1	Introduction, Collection of runoff, pipe system, design consideration, Road surface runoff (open drain and close)	
	3b	Identify the given methods of rainwater disposal.	3.2	Disposal of rain water (surface and under ground rainharvesting) - Overview of rainwater management Importance of effective rainwater disposal Design principles for surface rainwater harvesting systemsComponents: collection surfaces, gutters, downspouts, and storage, Maintenance and cleaning of surface systems.	CO3

UNIT III: Rainwater	3c	Identify safety mechanisms commonly used in lifts.	3.3	Construction aspects of Lift, types of lifts, Overview of lift systems and theri importance in building design Basic principles of lift operation.	
	3d	Identify the essential features of a lift.	3.4	Essential features of a Lift (machine room equipment, lift well,lift pit, lift landing door,lift car), Electrical requirements, Preventive maintenance & legal formalities of elevators.	
UNIT IV: Fire Services	4a	Identify the various types of fire fighting system.	4.1	Systems of fire fighting –External (pillar and flush hydrants), Internal (residential and industrial), training topersonnel for service & maintenance and safety measures.	CO4
	4b	Identify the key provisions and updates of the latest.	4.2	Maharashtra fire Prevention and Life Safety Measures Act.	
	4c	Identify the compliance requirements for effective fire safety management.	4.3	Fire Audit -Purpose and importance of fire auditsTypes of fire audits (internal vs. external) , Fire Safety Regulations and Standards - Relevant local and national codes (e.g., NFPA, IS codes) Compliance requirements.	
ination & Ventilation	5a	Interpret the strategies to minimize noise through special treatments.	5.1	Recommendations to minimise noise, special treatments ceiling, wall, floor, sound insulation.	
	5b	Interprete the factors affecting illumination for effective lighting planning.	5.2	Recommended value of illumination, factors affecting illumination- sources of day lighting, siting of buildings, design & planning.	

UNIT V: Acoustics, Illum	5c	Evaluate the concept of green building.	5.3	Green Building- Concept, advantages & comparison of green building with normal building. Green Building Standards and Certifications LEED (Leadership in Energy and Environmental Design). Overview and certification. Acoustics and Noise, lightinging and levels, Key criteria and credits.	CO5

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the various Building Services required for the given Building.	2	CO1
II	2	Perform tests to check for leaks, water pressure.	2#	CO2
II	3	Design a basic plumbing system of water supply and distribution.	2#	CO2
II	4	Design a simple water supply system for a given building.	2#	CO2
II	5	Conduct Market Survey on varous pipes,pipe fitting & trap & write a report on that.	2#	CO2
III	6	Identify proper location for Lift/Escalator/elevator in commercial Complex.	2#	CO3
III	7	Analyze the Collected samples of storm water, residential grey water samples for various parameterssuch as pH, turbidity.	2#	CO3
III	8	Identify and examine the key components of lift systems, such as the lift car, hoistway, control panel,and drive mechanisms.	2#	CO3
III	9	Prepare Lift Standars as per norms.	2#	CO3
IV	10	Perform routine checks on fire extinguishers.	2#	CO4
IV	11	Perform safety measures associated with fire fighting systems.	2#	CO4
IV	12	Identify the LEED (Leadership in Energy and Environmental Design) certification process and criteria & write a report on it .	2#	CO4
V	13	Identify various methods of minimizing noise through sound insulation treatments for ceilings, walls, and floors & write a report on it .	2	CO5
V	14	Prepare a report of various sound insulation materials available in market.	2#	CO5
V	15	Suggest Noise Control Methods for Commercials.	2#	CO5

Note # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Building Services	2	C	02	02	02	6
			O	0	0	0	0
2	water & waste water	8	C	02	06	08	16
			O	0	0	0	0
3	Rainwater and Communication Services	8	C	02	06	10	18
			O	0	0	0	0
4	Fire Services	6	C	02	04	10	16
			O	0	0	0	0
5	Acoustics, Illumination & Ventilation	6	C	02	04	08	14
			O	0	0	0	0
Total		30	C	10	22	38	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q.1 To Q.35	1R2	1U2	1A2	2R2	2U2	2U2	2U2	35/35
	2A2	2A2	2A2	2A2	3R2	3U2	3U2	
	3U2	3A2	3A2	3A2	3A2	3A2	4R2	
	4U2	4U2	4A2	4A2	4A2	4A2	4A2	
	5R2	5U2	5U2	5A2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Prepare a report	5
2	Performance	10
3	Diagrams	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-
CO4	3	-	-	-	1	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Plumbing :Design & Practice	S.G. Deolalikar, Tata McGraW Hill Education Pvt. Ltd., 2004	10: 007462069X 13: 9780074620694
2	A Text Book on Building Services	R udaykumar, Eswar Press , 2007	
3	Building Construction: Design Aspects of Leakage and Seepage Free	Krishna Kant, Tata McGraw Hill Education Pvt. Ltd, 2001	10: 1259006069 13:9781259006067
4	National Building Code 2024	Bureau of Indian Standards	
5	Building Repair & maintainance Management	S.M.Patil, Standard Publisher,2009	13:9788175259805

XV e-References:

1. https://youtu.be/8jxRn-T_LCs?si=QuJGC60qQ5taDHbM, assessed on 30/12/2024
2. https://youtu.be/ktrv34zW7-A?si=2qpTHjevhxyAPPvq, assessed on 30/12/2024
3. https://youtu.be/27TUmzyL9DI?si=oRhRpiFfbjkHfou0, assessed on 30/12/2024

XVI List of Major Equipment/Machineries with Specification:

1. Model of a civil engineering structure depicting various components.
2. Chart showing detailing of lift, escalator and ramp.
3. Model of a civil engineering structure depicting various components of Solar
4. Model of a civil engineering structure depicting various components of Rain

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.D.K.Parbat	HOD in Civil Engineering	Government Polytechnic, Nagpur
2	N.K.Deshmukh	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mr.V.B.Dhait	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Dr.V.G.Kondekar	HOD in Civil Engineering	Government Polytechnic, Sakoli
5	DR.Abhay Shende	HOD in Civil Engineering	Priyadarshni College of Engineering,Nagpur

(Dr.D.K.Parbat)
HOD & Chairman PBOS, CE

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COURSE CURRICULUM

Program	:	Diploma in CE/EE/EC/IT/MT/PK/CM/AE/TX/AI/MK
Course Category	:	GE
Course Code	:	ME391H
Course Title	:	Heat Engine Technology

I Rationale:

This course introduces the fundamentals of heat engines, including IC and SI engines, essential across various engineering fields. Students learn to analyze engine performance, aiding in operation, selection, and maintenance of power devices. Applicable in industries like automotive, energy, and manufacturing, this multidisciplinary knowledge supports collaboration among engineers from electrical, civil, and other domains, promoting efficient, sustainable, and practical engineering solutions in real-world applications.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Work with Internal combuction and spark ignition engines.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** I.C. engines and its auxiliaries.

CO2: **Identify** faults of SI Engine and its components and service the engine.

CO3: **Interpret** different system in CI Engine and its faults.

CO4: **Maintain** cooling and lubrication system of I C Engine.

CO5: **Test** the performance of I C Engine.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to IC engine	1a	Classify given type of engine depending on various parameters.	1.1	Classification of I.C. engines, Different parts of I.C. engines and their functions.	CO1
	1b	Illustrate applications of given IC engines.	1.2	Applications of I. C. engine, Basic engine terminology: (Bore, stroke, TDC, BDC, Clearance volume, Swept volume, Compression ratio, Piston speed and Cut off ratio).	
	1c	Analyse given thermodynamic power cycle.	1.3	Thermodynamic Power Cycles: Working of 4 stroke engines (Otto cycle, Diesel cycle), PV and TS diagram.	
	1d	Compare applications of 2- stroke SI and CI engine.	1.4	Working of 2-stroke engine, Advantages and Application of 2-stroke SI and CI engine.	
ngine	2a	Analyze the theoretical and actual valve timing diagrams for four-stroke S.I. engines.	2.1	Working and application of Two and Four stroke S.I. engine. Theoretical and Actual Valve timing diagram for four stroke SI engines.	

UNIT II: Spark Ignition Er	2b	Illustrate the concept of Octane Number including Research Octane Number (RON) and Motor Octane Number (MON).	2.2	Combustion in SI engines, Octane Number, Research Octane Number (RON) and Motor Octane Number (MON) Concepts of pre-ignition and detonation.	CO2
	2c	Justify the requirement of different A:F mixture requirement in different condition of running of SI engine.	2.3	Carburetion: Fuel supply system, Function of carburetor, Air-Fuel mixture and fuel requirements of S. I. engines., Concept of Simple carburetor and its drawback.	
UNIT III: Compression Ignition Engine	3a	Draw actual valve timing diagram for low speed 4-stroke diesel engine.	3.1	Working and application of Four stroke C.I. engine. Theoreticall and Actual Valve timing diagram for four stroke CI engines.	CO3
	3b	Identify given fuel injection system in CI engine.	3.2	Fuel injection: Function of fuel injection system, Types of fuel injection systems, CRDI concept, Combustion in CI engines, Importance of Cetane Number.	
	3c	Justify the need of electronic injection system.	3.3	Working of Fuel injector, Fuel pump -Bosch type only, Need of electronic injection system.	
	3d	Differentiate given engines on the basis of given points.	3.4	Comparison between S.I. and C.I. engine. Comparison between two stroke and four stroke engine.	
System	4a	Illustrate the need for cooling in an I.C.engine, including effects of heat on performance.	4.1	Cooling: - Pupose of Cooling of an I. C. engine, Effects of Cooling of IC engine, Types of cooling system and their selection as per the type of engine.	

UNIT IV: Cooling and Lubrication	4b	Compare Cooling systems on various factors.	4.2	Types of Water / liquid cooling (Thermo-syphon and Forced circulation of water), Application and advantages of forced water cooling system. Comparison between water and air cooling. Different types of coolants.	CO4
	4c	Evaluate the applications of splash, pressure, and charge lubrication systems in various engine configurations in automotive engines.	4.3	Need of lubrication in an I.C. engine. Functions of lubrication system. Types of lubrication system and its application, Splash, Pressure and Charge lubrication system, Lubricant additives and their function.	
UNIT V: Testing and Emission control	5a	Calculate IP for given 4-stroke petrol engine data.	5.1	I.C. Engine testing: Need of testing, I.P, B.P, BSFC, ISFC, mean effective pressure, compression ratio. Thermal and mechanical efficiency. Morse test.	CO5
	5b	Analyze the trade-offs between engine performance and emissions control when adjusting air-fuel ratio.	5.2	Types of pollutants in exhaust emissions of petrol and diesel engines, Effects of exhaust pollutants on environment, Effect of air – fuel ratio on exhaust emission.	
	5c	Illustrate the need for continuous improvement in auto industry.	5.3	Need of pollution norms for vehicles, Bharat stage V and VI norms, Table of pollutants emitted from petrol and diesel engines, including carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons (HC), and particulate matter (PM) for LMV and HMV.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Inspect 2- stroke engine and identify its different parts.	2#	CO1
I	2	Inspect 2-stroke S.I. engine, note down its complete specification.	2#	CO1
I	3	Inspect 4- stroke S.I. engine locate its various parts.	2#	CO1
I	4	Inspect 4- stroke C.I. engine, identify its various parts.	2#	CO1
II	5	Perform basic maintenance tasks on a S.I. engine, such as checking and changing spark plugs, air filter, oil filter and oil.	2#	CO2
II	6	Perform troubleshooting of a carburetor.	2#	CO2
II	7	Service and inspect the given carburetor.	2	CO2
II	8	Test and diagnose ignition system components, such as spark plugs and ignition coils.	2#	CO2
III	9	Troubleshoot common issues related to the operation of a four-stroke CI / SI engine and apply appropriate solutions.	2#	CO3
III	10	Identify and label different types of fuel injection systems installed on CI engines.	2	CO3
IV	11	Inspect components of different types of cooling systems to understand their construction and function.	2#	CO4
IV	12	Identify function and interconnections and also observe the distribution of lubricant to different engine components on working model.	2#	CO4
V	13	Conduct engine tests in a laboratory environment and Identify the importance of engine testing in evaluating and optimizing engine performance and efficiency.	2#	CO5
V	14	Identify types of pollutants emitted from petrol and diesel engines, including carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons (HC), and particulate matter (PM).	2	CO5
V	15	Examine the evolution of emission standards, such as Bharat Stage V and VI norms, and their role in addressing environmental challenges.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to IC engine	5	C	04	04	04	12
			O	00	00	00	0
2	Spark Ignition Engine	7	C	04	06	06	16
			O	00	00	00	0
3	Compression Ignition Engine	7	C	04	06	06	16
			O	00	00	00	0
4	Cooling and Lubrication System	5	C	02	04	06	12
			O	00	00	00	0
5	Testing and Emission control	6	C	02	04	08	14
			O	00	00	00	0
Total		30	C	16	24	30	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q 1 to Q 35	1R2	1R2	1U2	1U2	1A2	1A2	2R2	35/35	
	2R2	2U2	2U2	2U2	2A2	2A2	2A2		
	3R2	3R2	3U2	3U2	3U2	3A2	3A2		
	3A2	4R2	4U2	4U2	4A2	4A2	4A2		
	5R2	5U2	5U2	5A2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Prepare experimental set up/Draw Line diagram for experiment	5
2	Performance and measuring different parameters/Collection of Data	10
3	Calculation, Result, Drawing Graphs (if any)/Drawing different sketches	5
4	Viva Voce/Answer to simple questions and submitting report in time	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	2	-	2	-	-
CO5	3	-	-	3	2	-	2	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Internal Combustion Engine	R. P. Sharma, Dhanpat Rai Publication, 2010	13: 9788189928469
2	A Course in Internal Combustion Engine (SI Units)	V.M. Domkundwar, Dhanpat Rai & Co. Ltd. Publication, Fourth edition, 2014	13: 978-81-7700-116-7
3	Internal Combustion Engine	V. Ganeshan, Mcgraw Hill Education, 4th Edition, 2012	13: 9781259006197 10: 1259006190
4	Internal Combustion Engine	H. B. Keswani, Standard Book, 4th Edition, 2003	10: 81900893511
5	IC Engines Combustion and Emissions	Pundir B. P.Narosa Publishing House, New Delhi, 2010	13: 978-8184870879
6	A Textbook of Internal Combustion Engines	Rajput R.K. Laxmi Publications; Third edition, New Delhi, 2016	13: 978-8131800669

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1. https://www.youtube.com/watch?v=pqa4zCo4erY , assessed on 23rd August, 2016
2. https://www.youtube.com/watch?v=s2WGFELXPNg assessed on 23rd August, 2016
3. automobiletechinfo.blogspot.com/.../dtsi-digital-twin-spark-ignition-system.html assessed on 23rd August, 2016
4. https://www.youtube.com/watch?v=H2J0lSTYVhQ assessed on 23rd August, 2016
5. https://www.youtube.com/watch?v=H2J0lSTYVhQ assessed on 23rd August, 2016
6. www.cpcb.nic.in/Vehicular_Exhaust.php assessed on 23rd August, 2016
7. https://jalopnik.com/how-variable-valve-timing-works-500056093
8. https://www.araiindia.com/pdf/Indian_Emission_Regulation__Booklet.pdf

XVI List of Major Equipment/Machineries with Specification:

1. Test rig of four stroke petrol/ diesel engine.
2. Test rig on two stage reciprocating air compressor. Pressure and temperature gauges at suitable locations with manometer. Minimum ½ HP compressor
3. Working Model of fuel pump, injector & carburetor.
4. Working Model of S.I. / C.I. engine, Lubrication system and cooling system.
5. Demonstration Model & chart of cooling, lubrication & fuel supply system of I. C. engine
6. Exhaust gas analyzer 3/5 gas analyzer.
7. Single cylinder IC engine suitable for assembly/ dismantling with necessary tool set. (Engine complying latest Euro Norms)
8. Multi cylinder IC engine suitable for assembly/ dismantling with necessary tool set. (Engine complying latest Euro Norms)
9. Test rig on multi cylinder IC engine. 3/5/7 HP petrol engine with required accessories.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Prof. A. R. Umale	HOD Mechanical Engineering (Section A)	Government Polytechnic, Nagpur
2	Prof. A. A. Jagdale	HOD Mechanical Engineering (Section B)	Government Polytechnic, Nagpur
3	Prof. N. J. Burbure	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
4	Prof. G. H. Dahole	I/C HOD Mechanical Engineering	Government Polytechnic, Gondia
5	Prof. G. F. Potbhare	Principal	NIT Polytechnic, Nagpur
6	Prof. A. R. Sheikh	Director	A. R. Automation, Jafar Nagar, Nagpur
7	Prof. S. R. Kaduskar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
8	Prof. S.H.S. Patel	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur

(Prof. A. R. Umale)
HOD & Chairman PBOS, ME

(Dr. G. V. Gotmare)
Member Sectretary PBOS, ME

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EC/PK/AI/CM/IT/PK/MT/TX/AE
Course Category	:	GE
Course Code	:	EE391H
Course Title	:	Electrical Wiring and Estimation

I Rationale:

This course equips learners with essential skills in wiring and estimation of electrical installation projects. Students will understand basic concept of wiring, Layout, installation plans and calculation of material required also they are aware about current market rates. This course emphasizing hands-on experience and safety standards. It prepares future electrical technicians and supervisors for field demands, ensuring they are well-equipped to execute new installation projects effectively.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Prepare electrical estimates of electrical installations.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** various wiring tools, components and safety devices while undertaking any electrical work.

CO2: **Build** Various Wiring layouts.

CO3: **Prepare** documents of Quotations, Tenders and Contract

CO4: **Estimate** the cost and material required for residential and commercial electrical installation.

CO5: **Estimate** the cost and material required for industrial electrical installation.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
: Wiring tools, components and safety devices	1a	Identify the function of given electrical wiring tools.	1.1	Tools used in Electrical Wiring and its functions:Pliers and its types, Cutter, Screw driver, Tester, Test lamp, Crimping tool, Continuity tester, Electrician knife, Wire Gauge, Insulation remover.	CO1
	1b	Identify the function of given components used in electrical wiring system with their specification.	1.2	Different Components used in wiring systems and its function along with specifications: Various types of switches, Plugs, Sockets, DBs, MCBs, MCCBs, RCCBs, RCBs, Holders, Wires, Cables.	
	1c	Select the given safety accessories used in electrical wiring.	1.3	Significance of Electrical Safety, Electrical Safety Accessories such as Hand gloves, Helmet, Safety Shoes, Goggles, Rubber mats. Various types of fire extinguishing techniques.	

UNIT I	1d	Select the given type of earthing for given installation.	1.4	Earthing: Need of Earthing, Types of earthing such as Rod, Pipe and Plate. Earth resistance values for various installations as per IEEE standards. Measurement of earth resistance by Earth tester.	
UNIT II: Electrical Wiring Circuit system	2a	Identify wires based on colour codes.	2.1	Differentiation between wires and cables based on structure, Flexibility, Durability, Strength, Application and cost. Various sizes of wire and cable according to current carrying capacity. Colour coding of wire and cable in AC & DC system as per IS 732.	CO2
	2b	Identify given types of wiring system.	2.2	Different types of electrical Wiring systems - Surface conduit, concealed conduit, PVC casing capping with their application.	
	2c	Identify the given symbols used in electrical drawing.	2.3	Terminoloigy of electrical wiring drawing: Wiring Layout, Wiring Diagram, Single line diagram and Installation Plan. Different Symbols used in electrical wiring drawing.	
	2d	Implement the different wiring Layout as per the given functional requirements.	2.4	Different wiring Layout: 1. One lamp control from one place. 2. One lamp, one fan & one tube light control from switch on board. 3. Staircase Wiring Layout. 4. Go-down wiring Layout. 5. Bell Circuit. List various components and accessories used in above wiring system.	

UNIT III: Estimate, Contract, Tender and Quatation	3a	Justify the need of given type of estimates.	3.1	Need of estimation, Qualities of good estimator, Essential elements of Estimation. Meaning and purpose of- Rough Estimate, Detailed Estimate, Supplementary Estimate, Annual maintenance Estimate and Revised Estimate. Factors to be considered while preparing estimate.	CO3
	3b	Identify the role and qualities of good contractor.	3.2	Concepts of contract and their types, Contractor and their role, Qualities of good Contractor.	
	3c	Prepare the tender documents for given requirement.	3.3	Concept of Contract and their types, Tender Notice, Preparation of Tender document and method of opening of tender. Concept of Quotation and its different formats. Comparison between Tender and quotation. Comparative statement, format of comparative statement. Order format, Placing of purchasing order. Principles of execution of works, Planning, Organizing and completion of Work. Billing of Work.	
	4a	Interpret given civil engineering building drawing.	4.1	Residential Installation: Necessity and reading of Civil Engineering Building Drawing. General requirements and Inspection of Electrical installation according to IS: 732. Guidelines on design and construction of wiring installations as per part I section 9 of NEC- 2011.	

Γ IV: Residential and Commercial Installation	4b	Compare industrial and non-industrial Installation on the basis of given criteria.	4.2	Compare industrial and non-industrial Installation on the basis of purpose, load capacity, design complexity, voltage level, Safety, wiring system, Equipment & Components, Cost.	
	4c	Estimate material required for given Residential installation on the basis of given data.	4.3	Rules related to lighting load followed in electrical installation: 1. Positioning of equipment-Importance of plan and layouts. 2. Principles of circuit design in Lighting and power circuits- a) Light and fan circuit b) Power circuit. 3. Load calculation and selection of size of conductor- a) Load assessment b) Selection of size of conductor. 4. Selection of rating of main switch and protective switchgear. 5. Calculation of length of wire and other materials. 6. Calculation of labour cost. Sequence to be followed for preparing estimate.	CO4

UNIT	4d	Estimate material required for given Commercial installation.	4.4	1. Design consideration of electrical installation in commercial buildings. 2. Calculate number of luminaries according to recommended values of illumination. 3. Calculate total load, deciding number of sub-circuits, Deciding size and rating of switch board and distribution boards, deciding size of cables. Deciding size of conduits, Bus bar and bus bar chamber. 4. The Mounting arrangement of switch board & distribution board. 5. Calculation of length of wire and other materials. 6. Preparation of material schedule - Calculation of labour cost, Estimation and costing of unit.	
UNIT V: Industrial Installation	5a	Interpret the given electrical Drawing of industrial installation.	5.1	Design consideration of industrial installations. Types of Industrial Installation. General characteristics of industrial building. Selection of wiring system. Drawing of wiring diagram and single line diagram for single phase and three phase motors.	
	5b	Determine the different quantities for given industrial load.	5.2	Calculation of total load, Selection and rating of wire & cable size, main switch, fuses, distribution board, bus-bar, cable route, motor starter, earthing wire & earthing. Calculation of length of wire and other Materials. Preparation of material Schedule, Calculation of labour cost, Estimation and costing of unit.	CO5

5c	Identify the different application of IOT (Internet of things) in Building Installation	5.3	Concept of IOT in electrical installation. The application of IOT in Building Installation: 1. Smart Lighting System 2. Smart heatung , ventilation & air conditioner system. 3. Energy Management System. 4. Smart Security & Surveillance. 5. Smart Parking System.

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Use different types of wiring tools such as Combination Pliers, Nose Pliers, Cutter, Screwdriver, Continuity tester, Test Lamp, Crimping tools, Electrician tester and knife.	2#	CO1
I	2	Use different types of wiring equipment such as Switches, Sockets, Plugs, DB, MCBs, RCBs, ELCBs, Holders, Wires, and Cables.	2#	CO1
I	3	Identify the use of different electrical accessories such as Hand gloves, Helmet, Boots, Goggles, Rubber mats.	2#	CO1
II	4	Build a circuit to control one lamp from one place and test the wiring for phase control on wiring board.	2#	CO2
II	5	Build a circuit to control two lamps from two places independently on wiring board using conduit wiring.	2#	CO2
II	6	Build a circuit to control one lamp from two place using two way switches on wiring board using casing capping wiring.	2#	CO2
II	7	Build a circuit to control Bell circuit used in residential installation.	2#	CO2
II	8	Prepare a installation plan and layout diagram of one room consist of Light, ceiling fan, socket. (Assume suitable parameters)	2#	CO2
III	9	Prepare a quotation of electrical material required for wiring 1 BHK house.	2#	CO3
III	10	Prepare a contract document for the supply and installation of electrical installation of 1 BHK house.	2#	CO3
IV	11	Estimate the cost of material for a one room residential electrical installation.	2#	CO4
IV	12	Prepare the Bill of material for a small commercial installation (e.g. Book depot / Grossary shop) from installation plan. (Part - I)	2#	CO4
IV	13	Prepare the Bill of material for a small commercial installation (e.g. Book depot / Grossary shop) from installation plan. (Part - II)	2#	CO4
V	14	Prepare the estimate cost of material for a floor mill. (Part - I)	2#	CO5
V	15	Prepare the estimate cost of material for a floor mill. (Part - II)	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Wiring tools, components and safety devices	4	C	04	04	02	10
			O	00	00	00	00
2	Electrical Wiring Circuit system	5	C	04	04	04	12
			O	00	00	00	00
3	Estimate, Contract, Tender and Quatation	5	C	02	06	08	16
			O	00	00	00	00
4	Residential and Commercial Installation	8	C	02	06	08	16
			O	00	00	00	00
5	Industrial Installation	8	C	02	06	08	16
			O	00	00	00	00
Total		30	C	14	26	30	70
			O	00	00	00	00

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q.1 to Q.35	1R2	1R2	1U2	1U2	1A2	2R2	2R2	35/35
	2U2	2U2	2A2	2A2	3R2	3U2	3U2	
	3U2	3A2	3A2	3A2	3A2	4R2	4U2	
	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
	5U2	5U2	5U2	5A2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Draw a circuit diagram, Equipment Selection	5
2	Performance	10
3	Calculation and Result	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	1	-	-	1	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Text Book on laboratory courses in Electrical Engineering	S.G.Tarnekar and P.K.Kharbanda, S.Chand & Company Ltd., Third, 1990.	13: 978-8121901048
2	Electrical Wiring Estimating & Costing	N.Allagappan, S.Ekambarram, Tata Mc-Graw Hill Publishing Co.Ltd, First Edition, 2010	13: 978-0074624784
3	Engineering Workshop Practice on Electrical & Electronics Engineering	Ms. J. Glory Priyadharshini, Dr.K. Sheela Sobana Rani, Ms. M.Prabha Maheswari & Ms. S.Gomathy, Notion Press, 1st Edition, 2021	13: 978-1639203819
4	Electrical Design Estimating and Costing	K.B. Raina, Dr.S. K.Bhattacharya, New Age International Publisher, First, Reprint 2010	13: 978-8122403633
5	A Course in Electrical Installation Estimating and Costing	J. B. Gupta, S.K. Kataria & Sons Publisher, January 2013	13: 978-9350142790

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1. https://en.wikipedia.org/wiki/Electrical_wiring, assessed on 10th Aug 2024
2. https://www.thespruce.com/electrical-wiring-1152909, assessed on 12th Aug 2024
3. https://www.vedantu.com/physics/types-of-wiring, assessed on 12th Aug 2024
4. https://www.turito.com/blog/physics/types-of-wiring, assessed on 12th Aug 2024
5. https://www.youtube.com/watch?v=syaGf_XUMxA, assessed on 18th Aug 2024
6. https://electricalinstallationservices.co.uk/what-is-an-electrical-installation, assessed on 24th Aug 2024
7. https://www.electrical-installation.org/enwiki/Main_Page, assessed on 31st Aug 2024
8. https://electricalindustry.ca/latest-articles/2694-iot-and-its-application-in-electrical-power-systems-part-1/

XVI List of Major Equipment/Machineries with Specification:

1. Crimping Tools: Handheld, suitable for terminal lugs, 0.5mm² to 6mm²
2. Wires and Cables: 1.5mm² to 6mm² copper conductor, PVC-insulated, 90°C-rated.
3. Digital Multimeter AC: 200mV to 750V, DC: 200mV to 1000V, Resistance Measurement: 200Ω to 20MΩ
4. Standard Wire guage Range: SWG 1 to 36
5. Pump: 1.5HP single-phase.
6. Motors: 10HP and 5HP three-phase, starter panels, and cables.
7. Megger 500V, 1000V, 0.01MΩ to 2000MΩ.
8. Earthing: GI earth rod, 1.5m.
9. Wiring Board: Plywood, predrilled for mounting components.
10. Earth Tester- Analog or digital, 0.01Ω to 2000Ω, 20V or 50V

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. M. C. Musale	I/c HOD, Electrical Engg.	Government Polytechnic, Nagpur
2	Dr. P. M. Daigavane	HOD, Electrical Engg.	G. H. Raisoni College of Engg. Nagpur
3	Mrs. Divya Piparode	Sr. Engineer	Powergrid Corporation of India Ltd. Nagpur
4	Mr. M. N. Gawande	Lecturer, Electrical Engg.	Government Polytechnic, Gondia
5	Mr. B. D. Wadhai	Lecturer, Electrical Engg.	Government Polytechnic, Nagpur

(Mr. M. C. Musale)
HOD & Chairman PBOS, EE

(Dr. G. V. Gotmare)
Member Secretary PBOS, EE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/CM/IT/PK/AI/MT/MC/AE/TX
Course Category	:	GE
Course Code	:	EC391H
Course Title	:	Microcontroller and Applications

I Rationale:

Microcontrollers are essential for embedding intelligence into various devices, offering the ultimate flexibility for controlling and automating tasks. They are used in applications ranging from consumer electronics to industrial systems, enabling precise control, real-time processing, and efficient resource management. This makes them ideal for diverse uses such as home automation, medical devices, and automotive systems.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Develop microcontrollers program for various applications.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Interpret** features of various versions of 8051 microcontrollers.

CO2: **Interpret** features of advance microcontrollers.

CO3: **Design** sketch in Arduino IDE.

CO4: **Design** Arduino based applications.

CO5: **Develop** IoT based System.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Microcontrollers	1a	Identify given elements of Microcomputer.	1.1	Evolution of Microcontrollers, Block diagram of Microcomputer, elements of Microcomputer, types of buses	CO1
	1b	Identify given Architecture on given points.	1.2	Comparison of Microprocessor and Microcontrollers	
	1c	Select versions of Microcontroller for specified application.	1.3	Need of Microcontroller, Family of 8051 Microcontrollers and their specifications, Versions of Microcontroller 89C51, 89C1051, 89C2051, 89C4051	
ed System Basics and Microcontrollers	2a	Identify given Components of Embedded System.	2.1	Introduction to embedded systems, Block diagram of the components of embedded system hardware, Advantages and applications of embedded systems, Difference between Embedded Systems and General computing systems.	CO2

UNIT II: Embedd Advance M	2b	Identify Features of given Advance Microcontrollers.	2.2	Features of 89C51, PIC, AVR, ARM Microcontrollers with their applications. Comparison between 89C51, PIC, AVR and ARM	
	2c	Identify Function of given pins of ATMega328.	2.3	Features of ATMega328 Pin Diagram of ATMega328	
UNIT III: Open Source Development Board (Arduino)	3a	Identify given Components of Arduino UNO R3	3.1	Arduino : Introduction to Open Source Prototype Platform Types of Arduino Boards Features of Arduino UNO R3 Components of Arduino UNO R3 Functions of each Pin of Arduino UNO R3	CO3
	3b	Choose Arduino Variables and Structure.	3.2	Embedded C Programming: Introduction to Arduino Functions(I/O only), Variables(Constants, Data Types only) and Structure	
	3c	Suggest Arduino Sketch of Blinking Inbuild LED	3.3	Installation of Arduino IDE Sketch of Blinking Inbuild LED in Arduino IDE	
UNIT IV: Interfacing of Input and Output Devices with Arduino	4a	Choose Arduino based system with LED, Relay, Switch.	4.1	Interfacing with LED, Interfacing with Relay, Interfacing with Switch.	CO4
	4b	Choose Arduino based system with Seven Segment Display, LCD.	4.2	Interfacing with Seven Segment Display, Interfacing with LCD.	
	4c	Choose Arduino based system with 4x4 Keyboard.	4.3	Interfacing with 4x4 Keyboard.	
	4d	Choose Arduino based system with Stepper Motor.	4.4	Interfacing with Stepper Motor.	
	4e	Choose Arduino based system with IR Sensors, Buzzer.	4.5	Interfacing with IR Sensors, Interfacing with Buzzer.	

UNIT V: Introduction to Internet of Things (IoT)	5a	Interpret Features of IoT.	5.1	Introduction to IoT (Internet of Things): Features of IoT, Advantages and Disadvantages of (IoT), Embedded Devices (System) in (IoT), IoT Architecture Applications of IoT	CO5
	5b	Identify given IoT Devices.	5.2	Introduction of IoT Devices: Major IoT Boards in Market(Raspberry Pi, Arduino, ESP8266, Sense HAT 8x8 RGB LED matrix, Bluetooth Module HC-05	
	5c	Suggest IoT System for Controlling home light using WiFi Node MCU(ESP8266) and Relay module.	5.3	IoT Platforms: ThingWorx, Thingspeak, blynk, Controlling home light using WiFi Node MCU(ESP8266) and Relay module	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Interpret Blocks of 89C51 microcontroller using Datasheet.	2	CO1
II	2	Interpret Blocks of ATMega328 microcontroller using Datasheet.	2#	CO2
III	3	Interpret Blocks of Arduino UNO R3 using Datasheet.	2#	CO3
III	4	Install Arduino IDE in Windows OS.	2#	CO3
III	5	Design Arduino Sketch for Blinking Inbuild LED connected to pin 13.	2#	CO3
IV	6	Develop and execute Arduino sketch to read the status of key from port pin and turn ON/OFF a LED connected to another port of Arduino UNO R3.	2#	CO4
IV	7	Design Arduino based system to interface Seven Segment Display with Arduino UNO R3 and display the numeric value 0 to 9.	2#	CO4
IV	8	Design Arduino based system to interface LCD with Arduino UNO R3 and display the string "G. P. Nagpur".	2#	CO4
IV	9	Design Arduino based system to interface 4x4 keyboard with Arduino UNO R3 and display the key pressed.	2	CO4
IV	10	Design Arduino based system to interface stepper motor with Arduino UNO R3 and rotate it in clockwise and anti-clockwise direction.	2#	CO4
IV	11	Design Arduino based system to interface buzzer with Arduino UNO R3.	2#	CO4
IV	12	Design Arduino based system to interface IR sensor module with Arduino UNO R3 and blink led/buzzer on object detection.	2#	CO4
V	13	Interpret Blocks of Raspberry Pi 4 Model using Datasheet.	2	CO5
V	14	Interpret Blocks of Node MCU(ESP8266) using Datasheet.	2#	CO5
V	15	Develop Embedded C Program for IoT System for Controlling home light using WiFi Node MCU(ESP8266) and Relay module.	4#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Microcontrollers	2	C	02	04	00	6
			O	0	0	0	0
2	Embedded System Basics and Advance Microcontrollers	2	C	02	06	00	8
			O	0	0	0	0
3	Open Source Development Board (Arduino)	8	C	02	06	08	16
			O	0	0	0	0
4	Interfacing of Input and Output Devices with Arduino	12	C	06	10	08	24
			O	0	0	0	0
5	Introduction to Internet of Things (IoT)	6	C	04	06	06	16
			O	0	0	0	0
Total		30	C	16	32	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q 1 to Q 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35
	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	3A2	4R2	4R2	4R2	4U2	4U2	4U2	
	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Devlopment of Program	5
2	Performance	10
3	Execution Process and outcome	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-
CO2	3	-	-	-	1	-	-	-	-
CO3	3	-	3	3	-	3	3	-	-
CO4	3	-	3	3	-	3	3	-	-
CO5	3	-	3	3	-	3	3	-	-
CO6	-	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	The 8051 Microcontroller and Embedded Systems Using Assembly And C	Muhammad Ali Mazidi, Pearson Education, Asia 2007, second edition	10: 8131710262, 13: 9788131710265
2	Architecture, Programming and Design	Raj Kamal, Tata McGraw-Hill Education, 2nd Edition2011	13: 978-0-070-66764-8
3	Exploring Arduino: Tools and Techniques for Engineering Wizardry	Jeremy Blum, Wiley, 2013	13: 978-1-118-54936-0
4	Beginning Arduino	Michael McRobetrs, Apress, 2nd Edition 2013	13: 978-1430250166
5	Beginning Arduino Programming	Brian Evans, Apress, 1st Edition 2011	13: 978-1430237778
6	Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects)	Kindle Edition	13: 978-1449393571

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1. https://docs.arduino.cc/language-reference/#functions, accessed on 06th September2024
2. https://docs.arduino.cc/language-reference/#variables, accessed on 06th September2024
3. https://docs.arduino.cc/language-reference/#structure, accessed on 06th September2024
4. https://www.javatpoint.com/iot-internet-of-things, accessed on 06th September2024
5. https://thingspeak.com, accessed on 06th September2024
6. https://blynk.io, accessed on 06th September2024

XVI List of Major Equipment/Machineries with Specification:

1. Pentium III Desktop Computer.
2. Arduino UNO R3 Development Board.
3. Node MCU(ESP8266)
4. General Peripherals Breaddboard, LED, Key, Buzzer,LCD, 4x4 keyboard, IR sensor module, Stepper motor

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	HOD, Electronics & Telecomm. Engg.	Government Polytechnic, Nagpur
2	Dr. V. H. Mankar	HOD, Electronics & Telecomm. Engg.	Government Polytechnic, Nagpur
3	Mr. S. D. Ambade	Lecturer, Electronics & Telecomm., Engg	Government Polytechnic, Nagpur
4	Ms. P. P. Rodge	Lecturer, Electronics & Telecomm., Engg	Government Polytechnic, Nagpur
5	Mr. Sandeep V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
6	Dr. V. J. Dongre	HOD, Electronics & Telecomm., Engg.	Government Polytechnic, Arvi
7	Prof. Mrs. Gazala Ali	HOD, Electronics & Telecomm., Engg.	Anjuman Polytechnic, Nagpur

(Dr. R. V. Yenkar)
HOD & Chairman PBOS, EC

(Dr. G. V. Gotmare)
Member Secretary PBOS, EC

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/MT/AE/TX/MK
Course Category	:	GE
Course Code	:	IT391H
Course Title	:	Cyber Security and Privacy

I Rationale:

The rise in internet usage has led to an increase in cybercrimes and illegal activities online. It's crucial to understand various cybercrimes and the importance of cybersecurity to protect personal, governmental, and organizational data and systems. Additionally, understanding cyber laws is essential to address crimes in cyberspace, ensuring legal protection against online fraud, hacking, and other malicious activities. Strong cybersecurity measures and legal frameworks are key to safeguarding the digital world.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use the techniques of cyber security.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** different types of cyber organized crime

CO2: **Analyze** the planning, risk events and concept of cyber attacks

CO3: **Identify** types of Cybercrimes related with mobile and wireless Devices

CO4: **Analyze** the conceptual foundation of cyber security awareness

CO5: **Identify** importance of Cyber Laws

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Cybercrime	1a	Justify given term of cyber crime.	1.1	Cyber Crime: Definitions, An origin of the Word, cybercrime and information security	CO1
	1b	Identify criminals, with given cyber crimes.	1.2	Criminals in cybercrime, Classification of cyber-crimes; cyber defamation, internet time theft	
	1c	Identify a type of cybercrime done in given statements.	1.3	Hacking, online fraud, software piracy, password sniffing, Identity theft	
UNIT II: Planning of Cyber Attacks	2a	Justify given term.	2.1	CIA traid, Data protection, Security terminologies	CO2
	2b	Identify type of cyber-attacks in given scenario.	2.2	Attacks: passive and active attacks, Five phases of hacking:Reconnaissance, scanning, gaining - access, maintaining-access, clearing tracks	
	2c	Select from given statements, that showing cyber stalking.	2.3	cyber stalking: types of stalkers, stalking of cyber stalking, Real life incidents of cyber stalking	

UNIT III: Cybercrime: Mobile/Wireless devices	3a	Identify type/technique used for given cyber crime scenarios.	3.1	Credit card/debit card fraud in mobile and wireless computing era- types and technique of credit card fraud.	CO3
	3b	Justfy given android security.	3.2	Android security: Media player control security, networking API security for mobile devices, hardware and software security.	
	3c	Identify causes for given Cyber attack related with application and software security.	3.3	Applications and software security:Mobile viruses, Securities from mobile computing applications, hacking Bluetooth mobile devices.	
UNIT IV: Cybercrimes and need for Cyber - Security	4a	Analyze givenonline cybercrime.	4.1	Online Scams: Charity scam, lottery Scam, Fake offer/fake job scam	CO4
	4b	Analyse given type of Cyber threats.	4.2	Cyber threats: Types of Cyber threats,The legal Scenario and perspectives - Introduction, cybercrime and the legal base for cybercrime around world, Importance and need cyber laws.	
	4c	Identify given Recovery methodology.	4.3	Data privacy, Back-up and Recovery methodologies	
UNIT V: Cyber Laws and Way forward	5a	Identify importance of given feature of IT Act 2000.	5.1	Cyber laws in INDIA:IT ACT-2000, Positive aspects of IT ACT 2000, Weak areas in IT ACT 2000	CO5
	5b	Analyse Amendmends in IT ACT.	5.2	Amendments In cyber laws:changes made in IT ACT, State Government's power Impacted by amendment in IT ACT	
	5c	Identify required punishment for given Cybercrime.	5.3	Punishment: cybercrime and punishment, Information technology and students (Technology and students: An Indian scenario)	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Check the network speed of your internet connection in computer LAB.	2#	CO1
I	2	Enable and disable network also check the data acceptance in network.	2#	CO1
II	3	Tackle and handle externally delivered web-link considering cyber-attack. (http & https)	2#	CO2
II	4	Take back-up and restore data using online platform. (Google drive, etc.)	2#	CO2
II	5	Check and configure IP settings on your PC. (Manual and Automatic).	2#	CO2
III	6	Clear and delete browsing history & unnecessary cache memory on your system.	2#	CO3
III	7	Identify and Configure network settings on your mobile devices.	2	CO3
III	8	Create a standard regulated high security password for social media or any other important transactions platform.	2#	CO3
III	9	Make hardware settings to share data on another device. (e.g:-Whenever connecting a cell phone to PC)	2#	CO3
IV	10	Configure settings related with permissions for downloading foreign applications on your mobile devices.	2#	CO4
IV	11	Perform a secure file sharing between two devices.	2	CO4
IV	12	Identify and configure web application settings for safe browsing.	2#	CO4
IV	13	Identify pattern and configure File sharing using various social media platform on your mobile device	2#	CO4
IV	14	Analyse and install antivirus on your computer system	2	CO4
V	15	Identify suitable cyber law performing stealing of data using file sharing	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Cybercrime	6	C	02	04	00	6
			O	0	0	0	0
2	Planning of Cyber Attacks	6	C	02	06	00	8
			O	0	0	0	0
3	Cybercrime: Mobile/Wireless devices	6	C	02	06	08	16
			O	0	0	0	0
4	Cybercrimes and need for Cyber - Security	6	C	06	10	08	24
			O	0	0	0	0
5	Cyber Laws and Way forward	6	C	04	06	06	16
			O	0	0	0	0
Total		30	C	16	32	22	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 1 to Q. 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35
	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	3A2	4R2	4R2	4R2	4U2	4U2	4U2	
	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing diagram/flowchart,	5
2	Performance	10
3	Use of techniques ,design, guidelines, principles, Process in execution	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	-	-	3	-	3	-	-
CO2	3	3	-	-	3	-	3	-	-
CO3	3	3	-	-	3	-	3	-	-
CO4	3	3	-	-	3	-	3	-	-
CO5	3	-	-	-	3	-	3	-	-
CO6	3	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	"Cyber Security" - Understanding Cybercrime, Computer forensic and legal perspective	Nina Godbole, Sunil Belapure, Wiley India Pvt. Ltd Reprint,2018	13:9788126521791
2	"Cyber security Managing systems-Conducting, Testing and Investigating Intrusion"	Thomas J. Mowbray, Wiley India Pvt. Ltd Reprint,2018	10:8121924405
3	Network Security Essentials: Applications and Standards	A William Stallings, Pearson Educaiton	13:9788131716649
4	Network Security and Management	Brijendra Sing, PHI, 2nd edition	13:9788120339101

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1. https://nptel.ac.in/courses/106/106/106106144, accessed on 18/09/2024 assesed on 20 aug 2024
2. https://onlinecourses.swayam2.ac.in/cec20_cs09/preview assesed on 20 aug 2024
3. https://www.youtube.com/watch?v=chtp9UaVBMk&ab_channel=MYSWAYAM assesed on 20 aug 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer System
2. C Editor
3. linux operating system
4. Networking devices router, switch

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. R.Mahajan	HOD, Information Technolgy	Government Polytechnic, Nagpur
2	Mr. Dipak Dhote	Operations Manager	IT Networkz Infosystem Pvt Ltd Nagpur
3	Dr. Rakesh Kadu	Assistant Professor	Ramdeobaba College of Engineering and Management Nagpur
4	Mrs. V. A. Raje	System Analyst	MSBTE, RO, Nagpur
5	Mr Lokesh L Bhadekar	Lecturer in Information Technolgy	Government Polytechnic, Nagpur

(Dr. A. R. Mahajan)
HOD & Chairman PBOS, IT

(Dr. G. V. Gotmare)
Member Secretary PBOS, IT

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma CE/ME/EE/EC/PK/IT/CM/MK/AI/AE/TR/TX
Course Category	:	GE
Course Code	:	MT391H
Course Title	:	Heat Treatment

I Rationale:

Heat treatment is crucial in metallurgical engineering for enhancing material properties such as strength, hardness, and toughness. It allows precise control over microstructures, tailoring materials to specific industrial needs. Understanding heat treatment equips students with essential problem-solving skills, ensuring quality control and effective failure analysis. This knowledge is vital for various industries, including automotive, aerospace, and construction, opening diverse career opportunities. Integrating heat treatment into the diploma curriculum ensures students are well-prepared for the challenges and demands of the metallurgical engineering field.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Carry out different heat treatment processes on steel to obtain desired properties.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Interpret** Fe-Fe3C diagram.

CO2: **Use** TTT Diagrams for different heat treatments.

CO3: **Find** Hardenability of steel using different methods.

CO4: **Recommend** proper heat treatment process to steels for given applications.

CO5: **Select** proper case hardening method for given applications.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Iron- Carbon Equilibrium Diagram	1a	Identify reactions in Fe-Fe3C Diagram.	1.1	Allotropic transformation of iron, Reactions in Iron- Carbon diagram, various phases in Fe-Fe3C diagram.	CO1
	1b	Choose critical temperatures from Fe-F3C diagram.	1.2	Critical temperatures in Iron-carbon diagram.	
	1c	Classify steel and cast iron based on iron carbon diagram.	1.3	Classifications of plain carbon steel and cast irons with reference to iron carbon diagram.	
	1d	Identify microstructures of different steels and cast irons.	1.4	Microstructure and properties of plain carbon steels and cast iron with reference to iron carbon diagram.	
II: Principles of Heat Treatment	2a	Analyse heat treatment parameters.	2.1	Role and importance of heat treatment in the industry, safety preacutions in heat treatment shop. heat treatment parameters. Heat treatment cycles.	CO2
	2b	Compare different transformation mechanism based on different points.	2.2	Austenitization: mechanism of formation of Austenite, Pearlitic and Martensitic Transformation.	

UNIT I	2c	Use TTT Diagram for heat treatment.	2.3	T.T.T. diagram, construction of T.T.T. diagram from transformation curves, applications of TT Diagram	
UNIT III: Hardenability of steel	3a	Compare hardness with Hardenability based on given points	3.1	Hardenability - Concept of hardenabilty, factors affecting Hardenability. Hardness vs Hardenability.	CO3
	3b	Compare various Hardenability methods based on given points.	3.2	Determination of Hardenability of steel by Grossman method, Jominy end quench test.	
	3c	Select proper quenchants for given heat treatment.	3.3	Quenchant- Severity of quenchant, types and characteristics quenching mediums.	
UNIT IV: Heat treatment Processes	4a	Find heating temperature for various heat treatment processes.	4.1	Heating of steel- Heating time and temperature.	CO4
	4b	Compare different annealing processes on given points.	4.2	Annealing treatments : Purpose of Annealing, full annealing, partial annealing, diffusion annealing, isothermal annealing.Spheroidizing of steel.	
	4c	Identify normalised structure.	4.3	Normalizing – purposes, microstructural changes and its applications.	
	4d	Find hardening temperature for given steel.	4.4	Hardening: - Purpose of hardening selection of hardening temp. - Methods of quenching,Tempering - purpose of tempering - stages in tempering.	
V: Surface Hardening	5a	Compare different case hardeninmg methods.	5.1	Case hardening of steel - carburizing. Nitriding.	CO5
	5b	Select proper case hardening method.	5.2	Surface hardening of steel: Induction hardening - principle, equipments and steels used,Flame hardening- principle, equipments and steels used.	

UNIT	5c	Suggest remedies for different heat treatment defects.	5.3	General Heat Treatment defects, causes and remedies.

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Perform assignments based on Fe- Fe3c diagram.	2#	CO1
I	2	Carry microstructure analysis of steels and cast irons using Fe-Fe3C diagram.	2#	CO1
I	3	Carry microstructure analysis of steels and cast irons using Fe-Fe3C diagram. (Part II)	2	CO1
III	4	Determine hardenability of steel by Jominy End Quenched test.(Part II)	2#	CO3
III	5	Determine hardenability of steel by Jominy End Quenched test.(Part II)	2#	CO3
IV	6	Perform Annealing on steel. (Part I)	2#	CO4
IV	7	Perform Annealing on steel. (Part II)	2#	CO4
IV	8	Perform Normalizing on steel. (Part I)	2#	CO4
IV	9	Perform Normalizing on steel. (Part II)	2#	CO4
IV	10	Perform Hardening on steel with varying hardening temperatures to analyze effect of temperatures on hardness. (Part I)	2#	CO4
IV	11	Perform Hardening on steel with varying hardening temperatures to analyze effect of temperatures on hardness. (Part II)	2#	CO4
IV	12	Perform tempering on hardened steel at different temperatures. (Part I)	2#	CO4
IV	13	Perform tempering on hardened steel at different temperatures. (Part II)	2	CO4
V	14	Perform any one surface treatment process (carburizing, flame hardening) of steel. (Part I)	2#	CO5
V	15	Perform any one surface treatment process (carburizing, flame hardening) of steel. (Part II)	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Iron- Carbon Equilibrium Diagram	2	C	02	04	04	10
			O	0	0	0	0
2	Principles of Heat Treatment	2	C	02	04	06	12
			O	0	0	0	0
3	Hardenability of steel	8	C	02	04	08	14
			O	0	0	0	0
4	Heat treatment Processes	12	C	06	08	08	22
			O	0	0	0	0
5	Surface Hardening	6	C	02	04	06	12
			O	0	0	0	0
6			C				
			O				
Total		30	C	14	24	32	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
1	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35
2	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
3	3A2	4R2	4R2	4R2	4U2	4U2	4U2	
4	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
5	5R2	5U2	5U2	5U2	5A2	5A2	5A2	
6								

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance /report writing/submission	15
2	Vivo vice	10
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	3	-	-
CO2	3	-	-	-	3	-	3	-	-
CO3	3	2	2	2	3	-	3	-	-
CO4	3	-	-	-	3	-	3	-	-
CO5	3	2	2	2	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Introduction to Physical Metallurgy	Sidney H. Avner, McGraw-Hill International Edition, 2nd Edition, 1964	13:81-20300716-X
2	Material science & Metallurgy for engineers	V.D.Kodgire, S.V.Kodgire, Everest Publishing House, first Edition ,2011	10:8186314008 13:9788186314005
3	Physical Metallurgy for Engineers	Donald S. Clark , W.R. Varney, Van Nostrand Reinhold Company; 2nd Revised Edition, December 1962	10: 0442015704 13: 978-0442015701
4	Engineering Physical Metallurgy	Y. Lakhtin , CBS Publisher, 1st Edition, 2005	13:9788123906027 10:8123906021
5	Heat Treatment: Principles and Techniques	T.V.Rajan, C.P.Sharma, Ashok Kumar Sharma, Prentice Hall Of India. 2nd Edition 1994	13:978-81-203-4095-4

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3. https://www.youtube.com/watch?v=eHFI-xuZIiQ, assessed 16 March 2024
4. http://www.engmatl.com/index.php?start=6, assessed on 16 March 2024
5. http://downloadingisnotsin.net/material-science-and-metallurgy-by-kodgire-pdf-free-download/, assessed on 22 March 2024

XVI List of Major Equipment/Machineries with Specification:

1. Standard Fe-Fe3C equilibrium diagram
2. Muffle furnace- max temperature 10000c
3. Grinder- double ended
4. Polishing machine
5. Image analyzer
6. Microscope- magnification 100X
7. Emery papers
8. Flame hardening set up
9. Safety equipments and accessories
10. Hardness tester- Rockwell c scale

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Shri.K.L. Meshram	HOD, Metallurgical Engineering	Government Polytechnic, Nagpur
2	Miss.V.C. Humney	Lecturer Metallurgical Engineering	Government Polytechnic, Nagpur
3	Shri. Y.Y. Mahajan	Assist. Professor , Metallurgy & Material	VNIT , Nagpur

(Mr. K. L. Meshram)
HOD & Chairman PBOS, MT

(Dr. G. V. Gotmare)
Member Sectretary PBOS, MT

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/PK/CM/AE/AI/MK
Course Category	:	GE
Course Code	:	TX391H
Course Title	:	Garment and Fashion Technology

I Rationale:

This courseis designed for the students of other than Textile Deprtment. The Garment and Fashion Technology course equips students with the skills to design, produce and innovate garments using cutting edge technologies. Students master pattern making garment construction, textile science and fashion entrepreneurship. This fusion of creativity, technical expertise, and industry awareness prepares students for careers in fashion design, product development, and apparel manufacturing, driving innovation, sustainability, and excellence in the global fashion industry.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Manage fashion trends and apply on garments.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Suggest** the theories of fashion.

CO2: **Identify** the factors for clothing selection.

CO3: **Draft** a pattern for a garment.

CO4: **Use** cutting machine to cut the fabric.

CO5: **Use** sewing machine to stitch garment.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Fashion	1a	Select the given fashion terminologies.	1.1	Objective of Fashion. Basic fashion terminologies- Types of Fashion-Classic: Fad, Couture, Haute Couture, Label, Ensemble, Silhouette, Off-the-Rack	CO1
	1b	Identify the factors for given clothing selection	1.2	Fashion StyLe -Casual, Office Wear, Sports Wear, Classic, Exotic, Street, Vintage. Factors affecting textiles and clothing selection. Fashion cycle-Stages of fashion	
UNIT II: Fashion Design- Elements and Principles	2a	Apply elements of fashion design to make given garment.	2.1	Elements of Fashion Design - Line, Form, Shape, Texture and Colour.	CO2
	2b	Select the given principless of fashion.	2.2	Principles of fashion design- Balance, Proportion, Emphasis or Centre of Attraction, Rhythm, Harmony or Unity	

UNIT III: Garment - Marker planning and Pattern drafting	3a	Identify process flow chart for given Garment manufacturing	3.1	Importance of Garment industry. Process flow chart of Garment manufacturing. Principle of Garment Pattern drafting. Rules of Garment Pattern grading	CO3
	3b	Identify the pattern for given garment construction.	3.2	Draw Eight head theory, Planning, drawing and reproducing the marker. Marker planning, Methods of marker planning and Efficiency of marker plan.	
UNIT IV: Spreading and Cutting	4a	Classify the given fabric spreading methods.	4.1	Nature of fabric packages. Objective of spreading, Requirements of Fabric spreading process and methods of spreading	CO4
	4b	Use the given cutting devices.	4.2	Objectives of cutting process. Methods of cutting Manual and computerized. Types of cutting devices Straight knife, Round knie and Band knif.	
UNIT V: Sewing Machines	5a	Identify the given type of seam.	5.1	Objectives of sewing.Types of seams-Class 1: superimposed seam, Class 2: lapped seam, Class 3: bound seam, Class 4: flat seam.	CO5
	5b	Compare the given stitches on the given parameters.	5.2	Stitch types-Class 100 chainstitches, Class 200 hand stitches, Class 300 lockstitches and Class 400 multi-thread chain stitches	
	5c	Use sewing machine to stitch given garment.	5.3	Functions of sewing machine, Types of sewing machine, Parts of sewing machine and feed mechanism of sewing machine.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Draw and describe the different terminolgies of fashion.	02#	CO1
I	2	Draw and describe the different terminologies of fashion.	02#	CO1
I	3	Sketch any two styles of fashion.	02#	CO1
II	4	Sketch the different elements of fashion.	02#	CO2
II	5	Sketch the different principles of fashion design.	02#	CO2
III	6	Draw the flow chart of garment Industry.	02#	CO3
III	7	Draw pattern grading of any garment.	2	CO3
III	8	Use proper marker planning to improve efficiency of marker	2	CO3
IV	9	Use manual spreading technique to spread the fabric roll.	02#	CO4
IV	10	Use straight knife to cut the marked parts of garments.	02#	CO4
IV	11	Use round knife to cut the marked parts of garments.	2	CO4
V	12	Draw different types of seams and also practice on fabric.	02#	CO5
V	13	Draw different types of stitches and also practice on fabric.	02#	CO5
V	14	Use sewing machine to make to stitch the garment.	02#	CO5
V	15	Prepare any microproject based on garment and fashion designing.(Part I)	02#	CO5
V	16	Prepare any microproject based on garment and fashion designing.(Part II)	02#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Fashion	4	C	2	4	4	10
			O	0	0	0	0
2	Fashion Design- Elements and Principles	8	C	4	6	8	18
			O	0	0	0	0
3	Garment- Marker planning and pattern drafting	4	C	2	4	4	10
			O	0	0	0	0
4	Spreading and Cutting	6	C	2	6	6	14
			O	0	0	0	0
5	Sewing Machines	8	C	4	6	8	18
			O	0	0	0	0
Total		30	C	14	26	30	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q.1 TO Q.35	1R2	1U2	1U2	1A2	1A2	2R2	2R2	35/35	
	2U2	2U2	2U2	2A2	2A2	2A2	2A2		
	3R2	3U2	3U2	3A2	3A2	4R2	4U2		
	4U2	4U2	4A2	4A2	4A2	5R2	5R2		
	5U2	5U2	5U2	5A2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Draw neat sketches and working procedure.	10
2	Identify the functions of important parts.	5
3	Calculation	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	-	3	-	-
CO4	3	-	-	2	-	-	3	-	-
CO5	3	-	-	2	-	-	3	-	-
CO6	3	-	-	2	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Handbook of Garment Manufacturing Technology	Eiri Board, Engineers India Research Instt, 2003	10: 8189765027
2	Garment Manufacturing: Processes, Practices and Technology	Prasanta Sarkar, Online Clothing Study, 2015	13: 9789383701759
3	Garment Manufacturing Technology	D Nayak and R Padhye, Woodhead Publishing, 2015	13: 978-1-78242-232-7
4	The Technology of Clothing Manufacture	Carr and Latham, Blackwell Science Ltd. Second Edition, 1994	10: 6-632-03748-2
5	Apparel Manufacturing Technology	T Karthik, T.Ganeshanan, CRC press -2017	13: 978-1-4987-6375-2
6	The Complete Book of Fashion History	Jana Sedlackova,Walter foster Jr	13: 9781633221833
7	Fashion Design: The Complete Guide	John Hopkins,Ava Pub Sa; 2nd edition	13: 978-1350116573

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3. https://garmentsmerchandising.com/key-purposes-of-fabric-spreading/assessed on 25th may 2024.
4. http://www.fibre2fashion.com/industry-article/free-apparel-industry-article/4assessed on 25th may 2024.
5. textileflowchart.com/2014/12/flow-chart-of-garment-manufacturing-technology.html 4assessed on 25th may 2024.

XVI List of Major Equipment/Machineries with Specification:

1. Spreading table
2. Scissor
3. Staright knife
4. Sewing machine
5. Corel Draw and Adobe Photoshop Software

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr C.P.Kapse	I/C HOD Textile Manufacture	Government Polytechnic, Nagpur
2	Dr S.G.Gaikwad	Selection Grade Lecturer, Textile Manufacture	Government Polytechnic, Nagpur
3	Prof L.S.Chakraborty	Lecturer, Textile Manufacture	Government Polytechnic, Nagpur
4	Mr Laxminarayan Kaushik	Director	LLP Professionals, Nagpur
5	Prof. Harshal Ramteke	HOD Textile Technology	SASMIRA, Mumbai
6	Dr Ganesh Kakad	HOD Textile Engineering	JDIT, Yavatmal
7	Prof.S.S.Lawand	Selection Grade Lecturer Textile Manufacture	Government Polytechnic, Nagpur

(Dr. C. P. Kapse)
HOD & Chairman PBOS, TX

(Dr. G. V. Gotmare)
Member Sectretary PBOS, TX

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in AE
Course Category	:	GE
Course Code	:	AE391H
Course Title	:	Four Wheeler Technology

I Rationale:

This course is designed for the students who are studying diploma other than Automobile Engineering. This course equips students with a solid foundation in understanding the transformative impact of technology on the automotive sector. This course provides an overview of the four wheeler technology. By exploring recent trends, technological innovations, and emission regulations, students gain a holistic perspective essential for pursuing careers in automotive engineering and related fields. Key technologies covered include Automobile body technology, advancement in IC engines, Electric Vehicles (EVs), HVAC systems, Electronic Stability Control (ESC), Advanced safety and comfort systems along with On Board Diagnosis (OBD).

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply the Knowledge of advanced technology in four wheelers.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** the Vehicle bodies and select relevant body materials for better performance.

CO2: **Select** suitable advanced engine technology as per the requirements.

CO3: **Select** suitable HVAC systems keeping in mind the environmental and ethical aspects.

CO4: **Identify** the advanced accessories regarding passenger safety and comfort in the given vehicles.

CO5: **Diagnose** problems related with automotive systems and subsystems with the help of OBD.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Automobile Body Engineering	1a	Identify the body type of given vehicles.	1.1	Introduction to automobile bodies. Definition of body, terminology of a body, specifications of various vehicle body and comparison. Types of bodies and body construction.	CO1
	1b	Suggest the suitable materials for given parts of vehicular body.	1.2	Automobile body materials, fabrication and accidental repairs. Body Accessories and its functions.	
	1c	Justify, the effect of given parameters on performance of vehicle.	1.3	Streamlining shape of a vehicle body and its effects. Resistance faced by the vehicle Air resistance, rolling resistance, gradient resistance and Tractive resistance. Traction and Tractive efforts. Pitching, Bouncing, Rolling, Sway and Yaw.	
	1d	Justify the Protective and anticorrosive treatments of given vehicle with suitable reasons.	1.4	Protective and anticorrosive treatments, painting and repainting procedure.	

UNIT II: Advances in Automobile Engines and Electric Vehicles	2a	Compare MPFI engines with conventional engines on the basis of given parameters.	2.1	MPFI Engines: Drawbacks of Carbureted (SI) engines. Throttle body injection (TBI) and Port fuel injection (PFI) systems. Sensors and Actuators of MPFI engine.	CO2
	2b	Identify the components of given fuel injection system and write their functions.	2.2	CRDI Engines: Features of CRDI Engines, Major Components. Block diagram of CRDI. CRDI System operation and advantages.	
	2c	Justify the effect of given technology on the milage and performance of the engines.	2.3	Variable Geometric Turbocharger (VGT). Variable Valve timing mechanism (VVT). Gasoline Direct Injection (GDI) and Stratified - charge injection.	
	2d	Compare given emission control technology on the basis of given criteria.	2.4	Emission control: Exhaust - Gas recirculation (EGR)- EGR valve and control system. Positive crankcase ventilation (PCV) system. Evaporation emission control system.	
	2e	Compare given types of batteries used in EVs based on given points.	2.5	Electric Vehicles (EVs): Introduction to electric vehicles system, propulsion systems and charging infrastructure. Layout of Electric vehicles. Battery: Types of battery (Lithium ion battery, Battery Characteristics, Battery Management System (BSM)- operation Electric Motor: Types, components, functions and applications.	
Air Conditioning	3a	Justify the environmental and safety aspects of using HVAC system.	3.1	Environmental and safety aspects in car HVAC system. Fundamentals of Refrigeration and air conditioning. Description of vapour compression cycle.	

UNIT III: Car Heating, Ventilation and A (HVAC)	3b	Identify the components of given HVAC systems.	3.2	Components of Car Air Conditioning system. Layout and operation of HVAC. Heating and Ventilation system.	CO3
	3c	Compare the given properties for a given refrigerants.	3.3	Human comfort conditions. Type of refrigerants used in car air conditioning and their properties.	
	3d	Describe thecontrol of temperature and humidity inside the vehicles with justification.	3.4	Refrigerant Charging process for car AC system. Temperature control system, humidity control systems.	
UNIT IV: Advanced Automotive Accessories and Safety Devices	4a	Justify the purpose of given advanced automotive asseccories.	4.1	Purpose and Operation of advanced accessories: Keyless entry system, Common anti-theft system, Automatic door lock system. Park assists system.	CO4
	4b	Distinguish between given navigation systems.	4.2	Automatic headlight dimming. Automatic on/off headlight with time delay. Navigation systems: GPS, GPRS.	
	4c	Compare between different antidazzle devices on the basis of given points.	4.3	Construction and working of Sealed beam headlight. Control of headlight beam, headlight dazzle, Antidazzle devices.	
	4d	Compare between different safety devices on the basis of given points.	4.4	Safety devices – Air Bags, Seat Belt, Central locking, Collapsible steering, ABS and Electronic stability control systems.	
nponents and Systems	5a	Interpret the results of given type of sensor tests.	5.1	Construction, working and Testing of following sensors: Oxygen sensor, Engine coolant sensor, Intake air temperature sensor, Throttle position sensor, Manifold absolute pressure sensor. Vehicle Speed sensor, Mass airflow sensor, Knock sensor, crank shaft position sensor.	

UNIT V: Diagnosis of Automobile Cor	5b	Interpret the results of given type of actuator tests.	5.2	Types of Actuators and functions of actuators. Construction, working and Testing of following actuators: Electronic fuel Injector testing (Sound test, Ohmmeter test only).	CO5
	5c	Interpret 5-digit Diagnostic Trouble Codes (DTCs) as per SAE J2012 standards.	5.3	Onboard diagnosis (OBD): Purpose of onboard diagnostic second generation, Flash codes of Malfunction indicator light, OBD II Concept, SAE J2012 standards Diagnostic Trouble Code (DTC):-5 digits only.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the types of body and Materials used in body for a given vehicles.	2#	CO1
I	2	Identify the various suspension irregularities in the given vehicles. Suggest suitable remedies for them.	2#	CO1
II	3	Identify the components of MPFI engines and write their applications.	2#	CO2
II	4	Identify the components of CRDI engines and write their applications.	2	CO2
II	5	Identify the aggregates of EV, Draw layout of EV chassis, Record benefits of EV chassis as compared to chassis with I.C. engine.	2#	CO2
II	6	Perform multimter test on EV Components and interpret the results.	2#	CO2
III	7	Identify the components of HVAC systems. Draw the layout of HVAC system through observations.	2#	CO3
III	8	Measure the various temperatures of Car HVAC system and interpret the results.	2#	CO3
IV	9	Identify the various advanced accessories in the given vehicles and demonstrate their working.	2#	CO4
IV	10	Perform the operation of headlights and other accessories system for a given vehicle.	2#	CO4
IV	11	Identify the various safety devices used in given vehicles. Observe their working and correlate their applications.	2#	CO4
V	12	Identify the given sensors and actuators and write their applications.	2	CO5
V	13	Perform the multimeter test on given sensors and interpret the results.	2#	CO5
V	14	Perform the multimeter test on given actuators and interpret the results.	2#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Automobile Body Engineering	6	C	04	06	04	14
			O	00	00	00	00
2	Advances in Automobile Engines and Electric Vehicles	6	C	02	08	04	14
			O	00	00	00	00
3	Car Heating, Ventilation and Air Conditioning (HVAC)	6	C	02	04	08	14
			O	00	00	00	00
4	Advanced Automotive Accessories and Safety Devices	6	C	04	04	06	14
			O	00	00	00	00
5	Diagnosis of Automobile Components and Systems	6	C	02	06	06	14
			O	00	00	00	00
Total		30	C	14	28	28	70
			O	00	00	00	00

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C/O
Q1 to Q35	1R2	1R2	1U2	1U2	1U2	1A2	1A2	35/35
	2R2	2U2	2U2	2U2	2U2	2A2	2A2	
	3R2	3U2	3U2	3A2	3A2	3A2	3A2	
	4R2	4R2	4U2	4U2	4A2	4A2	4A2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of tools and equipment's.	5
2	Stepwise Procedure and Performance.	10
3	Conclusion and Result.	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	3	-	-
CO2	3	-	-	3	2	-	3	-	-
CO3	3	-	-	3	-	-	3	-	-
CO4	3	-	-	3	2	-	3	-	-
CO5	3	-	-	3	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Automotive Technology: A System Approach	Jack Erjavec, Robert Scharff, Delmar Publisher Inc., Second Edition	13: 9780827367241
2	Motor Automotive Technology	Anthony Schwaller, Delmar Publisher Inc., Second Edition, 1993	13: 978-0827351004
3	Automobile Mechanics	Donald L Anglin, William H Crouse, Tata McGraw – Hill, Tenth Edition, 2006	13: 9780028009438
4	Automotive Electricity, Electronics and Computer Controls	Barry Hollenbeck, Delmar Publishers, First Edition, 1998	13: 978-0827365667
5	Automotive Electrical Equipment	P. L. Kohli, Tata McGraw-Hill, 2006	10: 0074602160
6	Automobile Engineering Vol.II	R K Mohanty, Standard Book House, 2006	10: 81-900893-5-9
7	Automobile Engineering Vol.II	Dr. Kirpal Singh, Standard Publication,	13: 9788180141775

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4. https://www.youtube.com/watch?v=LGB6ZEjGm7Q&pp=ygURYWx0ZXJuYXRvciB0ZXN0ZXI%3D
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XVI List of Major Equipment/Machineries with Specification:

1. Two / Three types of Automobile Bodies.
2. MPFI Engines and CRDI engines.
3. Electric Vehicles components.
4. Electric Vehicle chassis or operational cut section of EV. Any make and model.
5. Working model of automotive car air conditioning system (HVAC).
6. Working model of Ignition system and Ignition coil tester.
7. Battery hydrometer, Battery load tester.
8. Digital Multimeters and Clamp type ammetesr.
9. Scan tool and accessories
10. Multiport fuel Injection Engine with sensors, actuators, ECM and all advanced accessories.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. G. K. Awari	HoD, Autombile Engineering	Government Polytechnic, Nagpur
2	Dr. S. D. Thakre	Sr. Lecturer, Automobile Engineering	Government Polytechnic, Nagpur
3	Prof. D. K. Bawane	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur
4	Prof. J M Syed	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur
5	Mr. Promod Nichat	Rtd. Asst. General Manager	Ashok Layland, Chennai
6	Dr. Suhas Kongre	Sr. Lecturer in Mechanical Engineering	ASTS Polytechnic, Wardha
7	Dr. Manoj Baseshankar	HOD, Mechanical Engineering	Suryodaya College of Engineering, Nagpur

(Dr. G. K. Awari)
HOD & Chairman PBOS, AE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, AE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/TX/AE/CM/MK/AI
Course Category	:	GE
Course Code	:	PK391H
Course Title	:	Injection Moulding & Blow Moulding

I Rationale:

This course introduces the fundamentals of injection and extrusion blow moulding with emphasis on packaging applications. It aims to provide cross-disciplinary knowledge to students from various engineering backgrounds. The course covers basic machine operations, mould design, materials, and product applications. Learners will understand the relevance of these processes in packaging and general manufacturing. It enhances technical awareness and supports skill development in polymer-based production methods.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply injection and extrusion blow moulding processes for manufacturing packaging components using appropriate materials, machinery, and quality control practices.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** and handle the feeding, motor, and drive systems of an injection moulding machine.

CO2: **Demonstrate** the barrel heating zones, clamping mechanism, and simulate the injection cycle.

CO3: **Observe** the cooling and ejection system and inspect injection moulded parts for defects.

CO4: **Identify** components of an extrusion blow moulding machine and simulate parison formation.

CO5: **Examine** blow mould cavities and demonstrate cooling and trimming procedures using samples. Evaluate blow moulded products for defects and differentiate design features based on application.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Fundamentals of Injection Moulding	1a	Justify the importance of injection molding in packaging.	1.1	Introduction and outline of the injection molding process.	CO1
	1b	Illustrate the principle of injection molding for packaging use.	1.2	Principle of injection molding and packaging-specific applications.	
	1c	Differentiate types of injection molding machines by design and application.	1.3	Types and constructional features of injection molding machines.	
	1d	Describe with justification the roles of main machine parts.	1.4	Main parts of the injection molding machine and their roles.	
	1e	Compare screw and plunger feed systems.	1.5	Barrel construction and material feed mechanisms (screw, plunger types).	

UNIT II: Mould Design and Injection Moulding Operation	2a	Illustrate core and cavity construction in mold design.	2.1	Mould design basics, core and cavity construction.	CO2
	2b	Differentiate runner systems and gate types with justification.	2.2	Runner system, mold venting, and gate types.	
	2c	Justify factors affecting shrinkage in molded parts.	2.3	Shrinkages in molded parts and factors affecting it	
	2d	Compare mold heating and cooling systems for performance.	2.4	Mould heating and cooling systems – types and functions.	
	2e	Illustrate ejection systems and their impact on cycle time.	2.5	Part ejection systems and cycle time optimization.	
UNIT III: Process Control, Applications & Defects in Injection Moulding	3a	Illustrate the full injection molding cycle with control points.	3.1	Complete process cycle and operation control.	CO3
	3b	Justify common packaging uses of injection molding.	3.2	Applications in packaging – caps, closures, containers, etc.	
	3c	Compare molding materials based on properties and use.	3.3	Types of materials used for packaging injection molding.	
	3d	Identify and justify causes of common molding defects.	3.4	Common injection molding defects (e.g., sink marks, short shot, flash)	
	3e	Justify corrective actions for injection molding issues.	3.5	Troubleshooting and corrective measures in molding.	
UNIT IV: Basics of Extrusion Blow Moulding	4a	Justify the role of blow molding in packaging.	4.1	Introduction to blow molding and packaging relevance.	CO4
	4b	Differentiate blow molding types by principle and use.	4.2	Principle and classification (extrusion blow, injection blow, stretch blow)	
	4c	Illustrate extrusion blow molding machine construction.	4.3	Construction and working of extrusion blow molding machine.	
	4d	Justify parison formation and extrusion head design.	4.4	Parison formation and extrusion head design.	
	4e	Compare materials used in blow molded packaging.	4.5	Material selection for extrusion blow molded packaging.	

UNIT V: Blow Moulding Operations	5a	Illustrate key features of blow mold design.	5.1	Blow mold design: cavity, neck finish, and parting lines, Clamping unit, inflation system, and cooling cycle.	CO5
	5b	Justify blow molding steps and wall thickness control.	5.2	Deflashing and trimming methods, Wall thickness control methods (parison programming), Process cycle – step-by-step working of extrusion blow molding.	
	5c	Illustrate applications and trends in blow molded packaging.	5.3	Packaging applications – bottles, jars, containers. Types of blow molded products and market trends.	
	5d	Identify and justify causes of blow molding defects.	5.4	Common defects – uneven wall thickness, flash, air entrapment.	
	5e	Justify quality control and innovations in blow molding.	5.5	Quality control in blow molded packaging. Innovations – multilayer blow molding, in-mold labeling, sustainability aspects.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Operate and Examine the Material Feeding System of an Injection Moulding Machine: Operate hopper and feeding zones. Identify granule flow, feeding mechanisms, and control settings.	2#	CO1
I	2	Identify and Analyze the Motor and Drive System Functionality: Trace electric/hydraulic drives. Observe screw rotation and injection control in operation.	2#	CO1
I	3	Observe and Record the Temperature Control Across Barrel Heating Zones: Inspect barrel sections. Measure set vs. actual temperatures and note heater arrangements.	2#	CO1
II	4	Demonstrate the Mould Clamping and Die Movement Process: Activate the clamping system. Observe toggle/hydraulic locking and safety interlocks.	2#	CO2
II	5	Perform Observation of Injection and Product Formation Cycle: Track plasticization, injection, mold filling, and part formation. Record parameters.	2	CO2
III	6	Monitor Cooling System Performance During the Moulding Cycle: Identify cooling channel layout. Measure cycle cooling time and coolant temperature.	2	CO3
III	7	Observe and Interpret the Ejection Mechanism Used for Part Removal: Inspect ejector pins, sleeves, or air systems. Monitor timing, part release, and safety.	2#	CO3
IV	8	Identify and Sketch Key Units of an Extrusion Blow Moulding Machine: Inspect and draw layout including extruder, die head, mold clamp and blowing station.	2#	CO4
IV	9	Monitor and Describe Parison Formation and Thickness Profile: Observe parison drop. Measure variation and note influence of temperature or flow.	2#	CO4
IV	10	Disassemble and Examine a Blow Mould for Neck and Cavity Design: Handle mould halves. Measure cavity shape and neck finish dimensions.	2#	CO4

IV	11	Operate and Study the Air Blowing and Cooling Cycle: Run or simulate blowing. Record pressure, cycle timing, and cooling phase.	2#	CO4
V	12	Observe and Record Trimming and Deflashing Operations: Handle post-processed parts. Identify flash areas, trimming tools, and defects.	2#	CO5
V	13	Inspect and Categorize Defects in Blow Moulded Products: Study defect samples. Classify based on appearance and identify probable causes.	2#	CO5
V	14	Collect and Compare Blow Moulded Packaging Applications: Gather different products. Identify materials used and packaging functions.	2#	CO5
V	15	Examine and Compare Mono-layer and Multi-layer Blow Bottles: Dissect and analyze sample bottles. Identify barrier layers and their functions.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Fundamentals of Injection Moulding	6	C	02	06	04	12
			O	00	00	00	00
2	Mould Design and Injection Moulding Operation	6	C	02	06	04	12
			O	00	00	00	00
3	Process Control, Applications & Defects in Injection Moulding	6	C	02	06	04	12
			O	00	00	00	00
4	Basics of Extrusion Blow Moulding	6	C	06	08	04	18
			O	00	00	00	00
5	Blow Moulding Operations	6	C	04	06	06	16
			O	00	00	00	00
Total		30	C	16	32	22	70
			O	00	00	00	00

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q.1 to Q.35	1R2	1U2	1U2	1U2	1A2	1A2	2R2	35/35
	2U2	2U2	2U2	2A2	2A2	3R2	3U2	
	3U2	3U2	3A2	3A2	4R2	4R2	4R2	
	4U2	4U2	4U2	4U2	4A2	4A2	5R2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Attendance & Punctuality	5
2	Regular Lab Performance	5
3	Record/Journal Submission (Quality of work / Neatness)	5
4	Viva Voce (During Sessions)	5
5	Internal Practical Test (Mock)	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	2	-	-
CO2	3	-	-	1	-	-	2	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	1	-	-	2	-	-
CO6									

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Handbook of Plastic Processes	Charles A. Harper, John Wiley & Sons, Inc., 1E, 2006.	13:978-0-471-662556 10: 0-471-66255-0
2	Plastics in packaging	A.S. Athaley, Tata McGraw-Hill,1E, 1992.	10: 0-07-460014-7
3	Rigid and Semirigid: Plastic Containers	J. H. Boriston, Longman Group Limited, 1E, 1994.	10: 0-582-01491-3
4	Handbook of package engineering	Joseph F. Hanlon , Robert J. Kelsey, Hallie Forcinio, CRC Press, Taylor & Francis Group, Third Edition, 1998.	13:978-1566763066 10: 1566763061
5	Advances in Plastic Packaging Technology	John Briston, Pira International, 1E, 1993	13: 9780902799967 10: 0902799967

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1 https://www.sorbentsystems.com/FlexiblePackageDesignGuide.pdf, Assessed on 18/10/2024
2 https://geminigroup.net/wp-content/uploads/2018/12/Plastic-Extrusion-Design-Guide.pdf, Assessed on 18/10/2024
3 https://www.dynisco.com/userfiles/files/Introduction_To_Extrusion.pdf, Assessed on 18/10/2024
4 https://personal.egr.uri.edu/vms/ISE%20240/Polymer_processing_VMS08.pdf, Assessed on 18/10/2024
5 https://crescent.education/wp-content/uploads/2019/02/MODULE-I-Injection-Molding-Process.pdf, Assessed on 18/10/2024

XVI List of Major Equipment/Machineries with Specification:

1. Injection molding machine.
2. Extrusion blow molding machine.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. Syed Imran Ahmed K.	I/c. Head of Packaging Technology.	Government Polytechnic, Nagpur.
2	Mr. Subhash N. Madhugiri	Head of Department, Packaging Technology (Rtd.)	Government Polytechnic, Nagpur.
3	Mr. Rajesh S. Raool	Lecturer in Packaging Technology (Rtd.)	Government Polytechnic, Nagpur.
4	Mr. Milind S. Deshpande	Lecturer in Mechanical Engineering.	Government Polytechnic, Arvi.
5	Mr. Prasad Balan Iyer	Director	SIES School of Packaging, Navi Mumbai – 400 705.
6	Mr. Uday D. Raut	Managing Director	B.R. Plastic Industries, MIDC, Nasik.
7	Mr. Ali Mohd Zeeshan MSM	Assistant Professor	Anjuman College of Engineering and Technology, Nagpur

(Mr. Syed Imran Ahmed K.)
HOD & Chairman PBOS, PK

(Dr. G. V. Gotmare)
Member Secretary PBOS, PK

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/MC/MT/PK/TX/AE
Course Category	:	GE
Course Code	:	CM391H
Course Title	:	Digital Marketing

I Rationale:

Digital marketing offers unparalleled opportunities for businesses to grow and succeed in the modern marketplace. Its ability to reach a wide audience, cost-effectiveness, and the potential for high engagement and measurable results make it an indispensable tool for any business looking to thrive in the digital age.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Use ethical and legal standards in computer engineering for digital marketing

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Explore** scope & necessity of digital marketing for various applications.

CO2: **Interpret** role of segmentation, Targeting and Positioning (STP) in digital marketing.

CO3: **Use** of Search Engine Optimization (SEO) for carrying out digital marketing.

CO4: **Analyze** Search engine marketing in context of digital marketing.

CO5: **Design** digital media campaign using appropriate mix of Face book and Twitter.

CO6: **Use** Web Analytic tool for different application.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

** Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Digital Marketing	1a	Identify the given marketing.	1.1	Evaluation of digital marketing: from traditional to modern marketing, premise of traditional marketing, Factors Impacting the Shift from Traditional to Modern Marketing, Advent of Modern Marketing Techniques	CO1
	1b	Select appropriate type of E-concept.	1.2	Growth of 'E' Concepts: from E-Business to Advanced E-Commerce, Understanding E-Models, difference between E-Business & E-commerce.	
	1c	Choose proper type of marketing strategy forthe given scenario.	1.3	Digital Marketing: an Introduction, Emergence of Digital Marketing as a Tool, Pull and Push Marketing, digital Marketing Applications and Benefits.	
	2a	Justify the need of segmentation	2.1	Segmentation: Concept , need and benefits of segmentation.	

UNIT II:Digital Marketing techniques	2b	Classify the given types of segmentation on the given criteria	2.2	Criteria for segmenting digital Audience-geographic, demographic, psychographic behavioral segmentation.	CO2
	2c	Choose the given marketing strategy based on condition	2.3	Targeting definition, Various target marketing strategies: mass marketing, segment marketing, niche marketing, micro marketing ,local marketing.	
	2d	Choose the use of Positioning in marketing context .	2.4	Positioning: definition of positioning in marketing, Types of positioning in marketing: pricing, quality, differentiation, convenience, customer service, user group.	
	2e	Identify the benefits of positioning.	2.5	Benefits of positioning in marketing: Create a strong competitive position, improve sales, define a target market, make more effective decisions, and connect to customer need.	
UNIT III: Search Engine Optimization (SEO)	3a	Select given terms related to SEO.	3.1	Introduction to SEO concept and role in digital marketing Understanding search engine optimization , common SEO techniques , content creation as SEO technique, SEO as marketing strategy	CO3
	3b	Select the given suitable method for given web page analysis in SEO.	3.2	Understanding search engine: search engine working, interaction of people with search engine,search engine marketing: keyword analysis,site popularity,web analytic & HTML tools, sponsored results.	
	3c	Choose proper tags in Search Engine Design in given example.	3.3	Search engine site design & development: indexablecontent, title tags, meta tags, link structure, Nofollow links, keyword usage, URL structure	

UNIT IV: Search Engine Marketing (SEM)	4a	Identify given terminologies in Social Media Marketing for given problem statement	4.1	Search Engine Marketing: concept of search engine marketing, terminology associated to SEM, Pay per click(PPC), Cost per click(CPC),Search engine result Page(SERP), Cost per mile(CPM), Landing page, SEO Vs PPC, Pay per click	CO4
	4b	Choose the given type of advertising tool for given product	4.2	Search engine advertising: Google Adwords, Bing Ads, Google search, google partners, google display network, campaign subtypes, specialized compaign subtypes: dynamic search ads, mobile apps, remarketing, engagement	
	4c	Select the steps for creating given adword account.	4.3	Google Adwords account setting: account access, linked accounts, notification setting, preferences Google AdWord account structure: Account, campaign ,Ad group	
	4d	Choose the use of given tool based on the problem statement.	4.4	Google Analytic: concept of Google Analytic, need of Google Analytic, how to set up a free Googleaccount,	
UNIT V: Social Media Marketing (SMM)	5a	Identify the difference for given social media websites on the given points.	5.1	Introduction to Social Media marketing, types of social media websites, mobile social media	CO5
	5b	Select steps for creating given page	5.2	Facebook : creating a facebook page, creating a facebook group	
	5c	Choose the proper terms used in twitter advertising .	5.3	Twitter Advertising: Use hashtags, retweet ,follow and get followed, Linkedln	
	5d	Choose the concept of Blogging for given senario.	5.4	Blogging: Types of blogs, blogging platforms, blogging recommendations, advertising on facebook, advertising on youtube	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
II	1	Prepare a report of a sample website with strategic flow for e-commerce/publication etc. with the use of: HTML,CSS,Javascript	02#	CO2
II	2	Apply role of STP for marketing of any product and prepare a detail report on it.	02#	CO2
III	3	Create account on Google Analytics or any other analytics tool	02#	CO3
III	4	Create the tracking id for web site and track links using Google Analytics tool	02#	CO3
III	6	Analyze web site traffic and leads using Analytics tool	02#	CO3
III	7	Prepare report on Search Engine Optimization(SEO) using Digital Marketing Platform	02#	CO3
IV	8	Demonstrate and install any Google Analytics plug-in for the website	02#	CO4
V	9	Use marketing features of any social media websites (eg. Facebook, Instagram .etc)	02#	CO5
V	10	Implement following using Google Analytics: Content Marketing and Website content optimization.	02#	CO5
V	11	Generate different type of reports through Google Analytic	02#	CO5
V	12	Analyze data using Google Analytics	02#	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Digital Marketing	6	C	04	06	04	14
			O	00	00	00	0
2	Digital Marketing techniques	6	C	02	06	06	14
			O	00	00	00	0
3	Search Engine Optimization (SEO)	6	C	04	04	06	14
			O	00	00	00	0
4	Search Engine Marketing (SEM)	6	C	02	06	06	14
			O	00	00	00	0
5	Social Media Marketing (SMM)	6	C	02	06	06	14
			O	00	00	00	0
Total		30	C	14	28	28	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	1U2	1U2	1U2	1A2	1A2	Q1 to Q35	
2	2R2	2U2	2U2	2U2	2A2	2A2	2A2		
3	3R2	3R2	3U2	3U2	3A2	3A2	3A2		
4	4R2	4U2	4U2	4U2	4A2	4A2	4A2		
5	5R2	5U2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Study of web pages and web site.	5
2	Installing and setting up a tool for web site	10
3	Interpretation of reports, result and conclusion	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	2	2	-	3	3	-
CO4	3	-	-	2	-	2	3	3	-
CO5	3	-	1	-	2	2	3	3	-
CO6	3	-	-	-	-	-	3		-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Fundamentals of Digital Marketing	Puneet Singh Bhatiya, Pearson publication	978-93-325-8737-3
2	Digital Marketing All in One for Dummies	Ryan Deiss	978-1-119-56023-4
3	Internet Marketing Pearson Education	Dave Chaffey,Kevin Johnston, Richard Mayer	978-81-31725191
4	Social Media Marketing All in One for Dummies	Jan Zimmerman and Deboarh	978-1-119-69687-2

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1. •http://www.smartinsights.com/digital-marketing-strategy/customer-segmentation-targeting/segmentation-targeting-and-positioning accessed on 13 July 2024
2. https://www.emarketinginstitute.org/free-ebooks/#google_vignette accessed on 13 July 2024
3. https://firstsiteguide.com/google-analytics-for-wordpress/ accessed on 13 July 2024
4. https://www.mageplaza.com/blog/positioning-in-marketing.html accessed on 13 July 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer system with all necessary peripherals and internet connectivity.
2. Web browser
3. Any Web Server(Tomcat)
4. Google Analytics

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.M.V.Sarode	HOD,Computer Engineering	Government Polytechnic, Nagpur
2	Mrs.D.S.Nalinde	Lecturer in CM	Government Polytechnic, Nagpur
3	Mr.P.S.Thakre	Lecturer in CM	Government Polytechnic, Nagpur
4	Dr.U.B.Aher	Lecturer in CM	Government Polytechnic, Nagpur
5	Dr.Rakesh Kadu	Assistant Professor, I.T	Ramdeobaba College of Engg, and Management, Nagpur
6	Mr.Dipak Dhote	Operations Manager,	IT-Network Infosystems Pvt LTD,Nagpur
7	Mrs.V.A.Raje	System Analyst	MSBTE ,RO,Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/PK/AI/MT/AE/TX
Course Category	:	GE
Course Code	:	MK391H
Course Title	:	Automotive Mechatronics

I Rationale:

This Generic Elective course is designed to introduce students from other branches to modern vehicle automation and electronic control systems. It covers fundamentals such as ECUs, sensors, actuators, transmission control, vehicle diagnostics, and emerging technologies like Drive-by-Wire and wireless communication protocols. The course enhances understanding of smart automotive systems, encouraging interdisciplinary learning and innovation in automation, essential for adapting to the evolving automotive industry and smart mobility solutions.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply knowledge of electronic control systems to analyze modern vehicle automation and diagnostic technologies.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** potential areas and recent technology of vehicular communication system.

CO2: **Classify** various types of sensors and actuators for automotive industry.

CO3: **Select** requirment of vehicular networking.

CO4: **Select** suitable various electronics accessories.

CO5: **Classify** the various type of electronically operated system.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Vehicular Applications	1a	Select the given electronic system for vehicular for specific application.	1.1	Electronic control unit (ECUs), ECU for fuel injector system.	CO1
	1b	Identify the given types of electronics control unit.	1.2	Engine system self – Diagnostics (On-Board Diagnostic) and EOBD.	
UNIT II: Sensors and Actuators	2a	Select the given types of sensors and actuator used in automotive industry.	2.1	Different types of Sensor and Actuator, example of various types of sensors.	CO2
	2b	Identify the given actuators used in industry.	2.2	Actuators: producing movement and other functions, Examples of different types of actuators, Electronics Control Unit (ECU) /actuator control signals.	

UNIT III: Driveline Infrotronic	3a	Select the given electronic system for driveline for specific application.	3.1	Selection of electronic system for driveline for specific application.	CO3
	3b	Identify the given types of transmission control systems.	3.2	Transmission control as a black box, Sensors and actuators used in transmission systems, Clutch electronic control.	
	3c	Select give types of hybrid vehicle.	3.3	Light hybrid power train, Technology: starter and generator. Electronic differential and four-wheel drive control.	
UNIT IV: Vehicle Networks and Data Exchange	4a	Select the various mode of vehicular communications.	4.1	Potential Wireless, Technologie ZigBee, UWB (ultra wideband), Bluetooth Wireless USB (Universal Serial Port) Wireless CAN.	CO4
UNIT V: Drive by wire System	5a	Identify the various component used in the drive by wire systems.	5.1	Introduction: Drive by Wire Systems, Current State of the art Advantages of drive by wire system.	CO5
	5b	Comapre given types of throttle wire systems.	5.2	Throttle By Wire Systems. Brake by wire system, electro-hyudraulic (EH). Electromechanical (EMg), Steer by wire system and safety monitoring/	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Identify the variuos components of Electronics Control Unit (ECU)	2#	CO1
II	2	Identify colour coading of wires used for sensor connection.	2#	CO2
II	3	Identify various types of sensor used in automation industry.	2#	CO1
II	4	Identify colour coading of wires used for actuator connection.	2#	CO2
II	5	Identify various types of actuators used in automation industry.	2#	CO2
III	6	Prepare report on infotraonic vehicular system by visiting mechatronics industry. (Part I)	2#	CO3
III	7	Prepare report on infotraonic vehicular system by visiting mechatronics industry. (Part II)	2#	CO3
III	8	Prepare report on infotraonic vehicular system by visiting mechatronics industry. (Part III)	2	CO3
IV	9	Prepare report on application and use of various networking technologies and its interfacing with vehicle by visit. (Part I)	2#	CO4
IV	10	Prepare report on application and use of various networking technologies and its interfacing with vehicle by visit. (Part II)	2#	CO4
IV	11	Prepare report on application and use of various networking technologies and its interfacing with vehicle by visit. (Part III)	2	CO4
V	12	Identify various types of electronics cluches.	2#	CO5
V	13	Identify various types of electromechanical, Electo-hydraulic, electromagnetic cluches.	2#	CO5
V	14	Assemble and disassemble elecromechanical clutch.	2#	CO5
V	15	Assemble and disassemble electromagnetic clutch.	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Vehicular Applications	6	C	04	04	04	12
			O	00	00	00	0
2	Sensors and Actuators	6	C	04	02	08	14
			O	00	00	00	0
3	Driveline Infrotronic	6	C	04	04	08	16
			O	00	00	00	0
4	Vehicle Networks and Data Exchange	6	C	02	06	06	14
			O	00	00	00	0
5	Drive by wire System	6	C	04	06	04	14
			O	00	00	00	0
Total		30	C	18	22	30	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q. 1 to Q. 35	1R2	1R2	1U2	1U2	1A2	1A2	2R2	35/35
	2R2	2U2	2A2	2A2	2A2	2A2	3R2	
	3R2	3U2	3U2	3A2	3A2	3A2	3A2	
	4R2	4U2	4U2	4U2	4A2	4A2	4A2	
	5R2	5R2	5U2	5U2	5U2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	System diagram, selection of equipment	5
2	Performance	10
3	Identification of compenets	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-
CO5	3	-	-	3	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Automobile Electrical and Electronics Systems	Tom Denton, Routledge, 5th edition, 2017	13: 978-0415725774
2	Automobile Electronics	Eric Chowanietz, Butterworth-Heinemann Ltd, 1995	13: 978-0750618786
3	Automotive Informatics and Communicative Systems: Principles in Vehicular Networks and Data Exchange	Huaqun Guo, Information Science Reference, 2009	13: 9781605663388
4	Intelligent Vehicle Technology and Trends	Richard Bishop, Artech House, Boston, 2005	13: 978-1630812737

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2. http://nptel.ac.in/downloads/108105063/, accessed on 4th July, 2024
3. https://www.industrialautomation.us/ access on 24 April 2024
4. https://www.plantautomation-technology.com/ access on 23 April 2024
5. https://www.linak.com/ access on 22 April 2024
6. https://www.kathirsudhirautomation.com/ access on 22 April 2024
7. https://www.timotion.com/ access on 23 April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Automated Guided vehicle
2. Automation load trasfer, wire guided.
3. Data capturing machine-plant code/option charactor recognition.
4. Demo kit of sensors, Electrical and pneumatic Actuators.
5. Diffrent types of Cluches

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. G.K. Awari	HOD, Mechatronics Engineering	Government Polytechnic, Nagpur
2	Ms. K. P. Thaware	Lecturer in Mechatronics Engg.	Government Polytechnic, Nagpur
3	Dr. Hemant B. Warkad	Junior Work Manager	OFA, Yatra India Ltd. Nagpur
4	Dr. Sachin M. Kale	Sr. Lecturer Electronics Telecomm.Engg.	Government Polytechnic, Nagpur
5	Prof.Vikash V. Mankar	I/C HOD Electronics Telecomm.	Priyadarshni Polytechnic, Nagpur
6	Mr.Kisanlal B. Badole	Design Engineer	Business Ready Solutions, Nagpur

(Dr. G. K. Awari)
HOD & Chairman PBOS, MK

(Dr. G. V. Gotmare)
Member Secretary PBOS, MK

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	DIPLOMA IN CE/ME/EE/EC/AE/MT/PK/TX/MK
Course Category	:	GE
Course Code	:	AI391H
Course Title	:	Machine Learning

I Rationale:

Machine Learning is a field within Artificial Intelligence in Computer Science that focuses on developing algorithms that mimic human learning processes. By leveraging statistical techniques, these algorithms are trained to make predictions based on data, enhancing the accuracy of software applications without requiring explicit programming for each task. Machine learning is a crucial skill in Data Science, enabling data scientists to harness historical data to predict outcomes. These predictions provide valuable insights that help businesses make informed decisions.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Comprehend the knowledge of the foundational concepts of AI.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** uses and applications of machine learning in real life.

CO2: **Implement** preprocessing steps on data to make it ready for analysis.

CO3: **Apply** classification algorithms and regression algorithms for predictive analysis

CO4: **Implement** clustering algorithms on data models and build them.

CO5: **Use** the concepts of ML in IoT.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	-	-

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction to Machine Learning	1a	Compare the given types of machine learning on given points.	1.1	Introduction to Machine Learning. Overview and History.	CO1
	1b	Compare the various types of Ml based on the given points.	1.2	Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning.	
	1c	Compare Training and Testing on the basis of given points.	1.3	Features, Labels, Training, Testing.Applications of ML.	
a and Datasets	2a	Distinguish between the various types of data based on given points.	2.1	Understanding Datasets: Types of Data, Cleaning Data, Handling Missing Values.	CO2
	2b	Select a suitable model for the given data with justification.	2.2	Feature Scaling and Normalization.	

UNIT II: Dat	2c	Analyse the process of feature extraction and engineering on the given data.	2.3	Encoding Categorical Data.	
	2d	Identify the criteria on which data splitting is based.	2.4	Splitting Data into Training and Testing Sets.	
UNIT III: Supervised Learning	3a	Choose supervised learning model for the given situation with justification.	3.1	Introduction to Supervised Learning.	CO3
	3b	Compare given regression algorithms on the basis of given points.	3.2	Regression Algorithms: Linear Regression, Polynomial Regression.	
	3c	Select a suitable algorithm for classifying the given data.	3.3	Classification Algorithms: K-Nearest Neighbors (KNN).	
UNIT IV: Unsupervised Learning	4a	Analyse unsupervised learning concept by considering the given real life situation.	4.1	Introduction to Unsupervised Learning.	CO4
	4b	Compare given types of learning based on the given criteria.	4.2	Clustering Algorithms: K-Means, Hierarchical Clustering.	
UNIT V: Role of ML in IoT	5a	State the applications of IoT.	5.1	Internet of Things, It's applications	CO5
	5b	Distinguish between the various activities carried out in ML and IoT on the basis of given points.	5.2	Working of IoT and ML.	
	5c	Select type of algorithm for the given situation.	5.3	Role of Machine Learning for IoT. Data Analysis Automation by Machine Learning, The Predictive Power of Machine Learning.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Use Python Basic Libraries such as Statistics, Math, Numpy and Scipy a) Usage of methods such as floor(), ceil(), sqrt(), isqrt(), gcd() etc.b) Usage of attributes of array such as ndim, shape, size, methods such as sum(), mean(), sort(), sin() etc. c) Usage of methods such as det(), eig() etc. d) Consider a list datatype (1D) then reshape it into 2D, 3D matrix using numpy e) Generate random matrices using numpy f) Find the determinant of a matrix using scipy. Find eigenvalue and eigenvector of a matrix using scipy	2#	CO1
II	2	Develop basic Python scripts, understanding data types, loops, functions, and libraries like NumPy, Pandas, and Matplotlib.	2#	CO2
II	3	Implement the following actions of Creating and Loading different types of datasets in Python using the required libraries. a) Creation using panda b) Loading CSV dataset files using Pandas c) Loading datasets using sklearn	2#	CO2
II	4	Develop a python program to compute Mean, Median, Mode, Variance, Standard Deviation using Datasets	2#	CO2
II	5	Execute various data pre-processing techniques for a given dataset. Develop a python program to compute a) Reshaping the data, b) Filtering the data,c) Merging the data, d) Handling the missing values in datasets , e) Feature Normalization: Min-max normalization	2#	CO2
III	6	Implement simple linear regression, train the model, and evaluate using Mean Squared Error (MSE).	2#	CO3
III	7	Implement the Multiple Regression for iris dataset.	2#	CO3
III	8	Implement KNN Classification model for a given dataset. Vary the number of k values and compare the results.	2#	CO3
IV	9	Develop a python program to implement K-Means clustering Algorithm. Vary the number of k values and compare the results.	2#	CO4

V	10	Implement a IoT based ML model using libraries like TensorFlow or Keras, understanding layers, activation functions, and backpropagation.	2#	CO5
V	11	Develop a mini project using IoT and ML for the medical application	2#	CO5
V	12	Execute the following - Choose a dataset, define a problem statement, apply machine learning algorithms, evaluate the models, and present findings.	2#	CO5
V	13	Implement an End-to-end machine learning project including data collection, preprocessing, model building, evaluation, and deployment.	2	CO5
V	14	Develop a mini project using IoT and ML for the commercial l application	2	CO5
V	15	Develop a mini project using IoT and ML for the Library application	2	CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction to Machine Learning	2	C	02	04	00	6
			O	0	0	0	0
2	Data and Datasets	6	C	02	06	00	8
			O	0	0	0	0
3	Supervised Learning	8	C	02	06	08	16
			O	0	0	0	0
4	Unsupervised Learning	8	C	06	10	08	24
			O	0	0	0	0
5	: Role of ML in IoT	6	C	04	06	06	16
			O	0	0	0	0
6			C				
			O				
Total		30	C	16	32	22	70
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C
Q 1 to Q 35	1R2	1U2	1U2	2R2	2U2	2U2	2U2	35/35
	3R2	3U2	3U2	3U2	3A2	3A2	3A2	
	3A2	4R2	4R2	4R2	4U2	4U2	4U2	
	4U2	4U2	4A2	4A2	4A2	4A2	5R2	
	5R2	5U2	5U2	5U2	5A2	5A2	5A2	

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Writing Program (Execution)	5
2	Performance	10
3	Viva Voce	10
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	3	3	3	-	3	-	-
CO2	3	-	3	3	3	-	3	-	-
CO3	3	-	3	3	3	-	3	-	-
CO4	3	-	3	3	3	-	3	-	-
CO5	3	-	3	3	3	-	3	-	-
CO6	3	-	3	3	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Machine Learning	SaikatDutt ,Subramanian Chandramouli, Amit Kumar Das, Pearson Education India, 2018	13:978-9353066697
2	Machine Learning for absolute begineers	Oliver Theobald , Scatterplot Press; 3rd edition , 2020	13:979-8558098426
3	Machine Learning	Tom M Mitchell, McGraw Hill, First edition, 1997	13:978-0070428072

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2. http://www.dkriesel.com/en/science/neural_networks, accessed on 29th July 2024
3. https://www.youtube.com/results?search_query=artificial+intelligence, accessed on 29th July 2024
4. https://www.youtube.com/watch?v=s-s9ilkMVj8, accessed on 29thJuly 2024
5. https://www.javatpoint.com/subsets-of-ai, accessed on 29th July 2024
6. https://www.youtube.com/watch?v=s-s9ilkMVj8, accessed on 29th July 2024

XVI List of Major Equipment/Machineries with Specification:

1. Computer system with latest configuration.
2. Software: opensource framework, AItools (ScikitLearn,TensorFlow,Auto ML,H2O,google ML kit)

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. R. Mahajan	HOD, Information Technology	Government Polytechnic, Nagpur
2	Dr.Paresh R. Kamble	Machine Learning specialist	OZ SportZ, Nagpur, HQ-Reykjavik, Iceland
3	Dr. Vijaya Balpande	Associate Professor	Ramdeobaba College of Priyadarshini College of Engg., Nagpur
4	Mrs. Shifa Azharuddin	Lecturer in IT	Government Polytechnic, Nagpur
5	Dr. S. S. Gharde	Lecturer in IT	Government Polytechnic, Nagpur

(Dr. A R Mahajan)
HOD & Chairman PBOS, AI

(Dr. G. V. Gotmare)
Member Secretary PBOS, AI

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/CM/PK/MT/AE/AI/MK/TX
Course Category	:	GE
Course Code	:	TR391H
Course Title	:	Tourism Resources of India

I Rationale:

This multidisciplinary course introduces students to India's adventure tourism potential, popular destinations, and activities. It promotes awareness of sustainability, safety, and environmental responsibility. Aligned with NEP 2020, the course develops transferable skills like strategic thinking, and risk assessment. It is relevant for students across disciplines such as environmental studies, sports, and highlights challenges and strategies in adventure tourism development.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Plan and conduct safe, equipment-based adventure tourism activities.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Identify** tourism resources in India.

CO2: **Select** suitable topography and equipment for land based adventure tourism.

CO3: **Select** suitable equipment for water based adventure tourism cosidering physical fitness and safety measures required.

CO4: **Select** suitable equipment for air based adventure tourism cosidering physical fitness and safety measures required.

CO5: **Identify** various Artificial Advature activities.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
2	-	2	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70**	100	40	25	10	25	10	25	10

**Online Objective Type

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction	1a	Classify to various tourism resources in India.	1.1	Indroduction to various tourism resources: Natural resources, Cultural resources.	CO1
	1b	Identify given Natural resources in India.	1.2	Natural resources: National park, Beaches, GHill stations, Water fall, Mountains	
	1c	Identify given cultural resources in India.	1.3	Cultural Resources: Historical Monuments, Temples and Pligimage sites, Festivals and Celebrations.	
UNIT II: Land Based Activities	2a	Identify major land-based adventure activities and their suitable destinations in India.	2.1	Mountaineering, Trekking, Rock Climbing, Skiing. Preferable destinations for adventure activities in India.	CO2
	2b	Identify essential equipment for land based adventure activities and relate them to tourist fitness requirements.	2.2	Necessary equipment for adventure activities. Energy level and physical fitness of Tourist.	
	2c	Apply appropriate safety measures and assess dos and don’ts in land-based adventure activities.	2.3	Dos and don’ts for tourists while undergoing adventure activities. Safety measures for land-based adventure sports.	

UNIT III: Water Based Activities	3a	Identify major water-based adventure activities and their suitable destinations in India.	3.1	Rafting, Kayaking, Canoeing, Yachting, Water Scooter, Hovercraft, Surfing, Scuba diving. Water Resources of India – Rivers, Seas and Lakes. Preferable destinations for adventure activities in India.	CO3
	3b	Identify essential equipment for water-based adventure activities and relate them to tourist fitness requirements.	3.2	Necessary equipment for Water Based adventure Activities. Energy level and physical fitness of Tourist.	
	3c	Apply appropriate safety measures and assess dos and don’ts in water-based adventure activities.	3.3	Dos and don’ts for tourists while undergoing Water Based adventure activities. Safety measures for water based adventure sports.	
UNIT IV: Air Based Activities	4a	Identify major air-based adventure activities and their suitable destinations in India.	4.1	Hang gliding, Hot Ballooning, Para Jumping, Parasailing, Sky diving. Preferable destinations for air based adventure activities in India.	CO4
	4b	Identify essential equipment for air-based adventure activities and relate them to tourist fitness requirements.	4.2	Necessary equipment for air based adventure activities. Energy level and physical fitness of Tourist.	
	4c	Apply appropriate safety measures and assess dos and don’ts in air-based adventure activities.	4.3	Dos and don’ts for tourists while undergoing adventure activities. Safety Measures for Air Based activities.	
UNIT V: Artificial Advature Tourism	5a	Identify various Artificial Advature activities.	5.1	Theme parks, Escape rooms, indoor climbing, Ziplining, Virtual reality experiences.	CO5
	5b	Locate Artificial Advature activities in India on map.	5.2	Locations of Artificial Advature activities in India.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Collect data and visuals from secondary sources (books, tourism websites, brochures) related to tourism resources in India.	2#	CO1
I	2	Identify and locate tourism resources in India on a map.	2#	CO1
II	3	Practice High hill trekking destinations. (Part I)	2#	CO2
II	4	Practice High hill trekking destinations. (Part II)	2#	CO2
II	5	Practice Rock Climbing.	2#	CO2
III	6	Prepare an observation based key learning points in Kayaking/Water Scooter.	2#	CO3
III	7	Prepare a Presentation on water based adventure sports activities.	2	CO3
III	8	Identify various equipments used in on water based adventure activities.	2#	CO3
IV	9	Follow the expert instructions of Parasailing/Hang gliding expert.	2#	CO4
IV	10	Identify various equipments used in on air based adventure activities.	2#	CO4
IV	11	Perform air based advanture activities by following safety measures.	2#	CO4
V	12	Prepare a report on artificial advanture activity you have experienced.	2#	CO5
V	13	Prepare a brouchure using self-photographed pictures and related information of the artificial advanture activities.	2#	CO5
V	14	Design an advertisement/promotional campaign for any one theme Park..	2	CO5
I to V	15	Prepare an adventure tourism package.	2	CO2 to CO5

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Introduction	4	C	02	04	04	10
			O	0	0	0	0
2	Land Based Activities	6	C	04	06	06	16
			O	0	0	0	0
3	Water Based Activities	6	C	04	06	06	16
			O	0	0	0	0
4	Air Based Activities	6	C	02	08	06	16
			O	0	0	0	0
5	Artificial Advature Tourism	8	C	02	04	06	12
			O	0	0	0	0
Total		30	C	14	28	28	70
			O	0	0	0	0

*C - Compulsory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
Q1 to Q 35	1R2	1U2	1U2	1A2	1A2	2R2	2R2	35/35	
	2U2	2U2	2U2	2A2	2A2	2A2	3R2		
	3R2	3U2	3U2	3U2	3A2	3A2	3A2		
	4R2	4U2	4U2	4U2	4U2	4A2	4A2		
	4A2	5R2	5U2	5U2	5A2	5A2	5A2		

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	10
2	Overall Presentation of given assignment	10
3	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	3	-	3	-	-
CO2	3	-	-	-	3	-	3	-	-
CO3	3	-	-	-	3	-	3	-	-
CO4	3	-	-	-	3	-	3	-	-
CO5	3	-	-	-	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Tourism Resources in India	Dr. V.K. Rastogi, Laxmi Publications Pvt. Ltd., 2022	13: 978-9395172073
2	Adventure Tourism	R. Buckley, CABI, 2006	10: 1845931238, 13: 978184593123
3	Adventure Tourism: The New Frontier	Rakesh Kumar Sah, Random Publications, July 2014	10: 9351113256 13:978-9351113256
4	Tourism Resources in India (Part-I) [Education, Travel & Business]	Dr. Tuhin Mukherjee, Manorama Publishers; First Edition, 2025	13: 978-9394441866
5	Tourism Products of India: A National Perspective	Robinet Jacob, Abhijeet Publications; 1st Edition, 2012	13: 978-9381136621

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2. https://www.mptourism.com/pdf/guidlines-for-wildlife-tourism.pdf accessed on 16th Dec 2024
3. https://tourism.gov.in/sites/default/files/2020-02/1527867024_gallery_image.pdf accessed on 16th Dec 2024

XVI List of Major Equipment/Machineries with Specification:

1. NIL

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.P. P. Virkhare	HOD, Travel and Tourism Department.	Government Polytechnic, Nagpur.
2	Mr Rajesh P Pund	Lecturer in Travel and Tourism	Government Polytechnic, Nagpur.
3	Dr Aarti Meshram	I/C Principal	GIHMCT, Nagpur.
4	Miss Erika Kar	Director	Pegasus Institute, Nagpur.
5	Mr Adityashekhar Gupta	Director	Horizon Safaris, Nagpur.
6	Dr Arvind Upasani	Visiting Lecturer	RSTM Nagpur University.

(Dr. P. P. Virkhare)
HOD & Chairman PBOS, TR

(Dr. G. V. Gotmare)
Member Secretary PBOS, TR

Semester VI

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE304H
Course Title	:	Water Resources Engineering

I Rationale:

Rainfall distribution has spatial and temporal variation all over the world. Water requirements have increased and the available water needs to be optimally used. This course enables students to proficiently estimate average rainfall, runoff, and flood discharge from data. It covers determining crop water needs and canal capacities, computing reservoir sizes with appropriate control levels, and selecting suitable dam and spillway types based on site conditions. Students will also gain skills in choosing minor and micro irrigation schemes and planning and designing canal structures to effectively manage and optimize water resources for agricultural and infrastructure needs.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Manage water resources, including dams and irrigation systems.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Estimate** average rainfall, Run off and Flood discharge from the given data.

CO2: **Determine** crop water requirement of command area and required capacity of canals

CO3: **Compute** capacity of reservoirs to meet water requirements and fix control levels.

CO4: **Propose** suitable type of dam and spillway structure for given site condition.

CO5: **Select** minor and micro irrigation scheme for the given situation.

CO6: **Plan** and maintain canal structures

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Hydrology	1a	Propose type of irrigation scheme for given requirements.	1.1	Definition, Necessity, Scope & Benefits of Irrigation, Ill effects of over- irrigation, Types of irrigation schemes- single & multipurpose projects.	CO1
	1b	Estimate average rainfall from given rainfall station data.	1.2	Definition of Hydrology & Hydrological Cycle, Rainfall-Factors affecting rainfall, Methods of calculating average rainfall, Simple numerical problems. Measurement of Rainfall-Symons and automatic rain gauge.	
	1c	Compute run-off using relevant method from the given data.	1.3	Definition of Run-off, factors affecting runoff, Computation of run-off, Simple numerical problems.	
	1d	Compute the Maximum flood discharge for a catchment using relevant method from the given data.	1.4	Catchment area -definition & types, Max. Flood discharge measurement- Definition, Rational method and empirical methods, Simple numerical problems.	

	1e	Determine dependable yield from the given catchment for the given data.	1.5	Yield and dependable yield of a catchment, determination of dependable yield.	
UNIT II: Water requirement of crop	2a	Differentiate between given types of cropping seasons in Maharashtra.	2.1	Crops and cropping seasons in Maharashtra- Kharif, Rabi, Hot weather and Perennial.	CO2
	2b	Compare periods on given points.	2.2	Base period, Crop period, Duty, Delta Gross Culturable & Irrigable Command Area, Intensity of irrigation.	
	2c	Suggest methods for improving duty under given site condition.	2.3	Factors affecting duty, Methods of improving duty; Definition of time factor, capacity factor.	
	2d	Calculate the water requirement of crops and capacity of canal from the given data.	2.4	Methods of application of Irrigation water and its assessment, Numerical on water requirements of crops and capacity of canal.	
UNIT III: Reservoir planning	3a	Select the site for reservoir from specified sites.	3.1	Data required for reservoir planning, Surveys for reservoir planning.	CO3
	3b	Draw area – capacity curve for given data.	3.2	Area – capacity curve.	
	3c	Suggest relevant measures of silt control in a given situation.	3.3	Silting of reservoir- Rate of silting, Factors affecting silting and control measures.	
	3d	Compute control levels for the given reservoir from the given data.	3.4	Fixing of control levels – Dead storage level, Full reservoir level, High flood level and Top of bund level. Flood absorption capacity of reservoir, Simple numerical problems on fixing of control levels.	
	4a	Justify the choice of dam for given site conditions.	4.1	Dams, Classification- Gravity and Earthen dams, Choice of type of dam under different situations.	

UNIT IV: Dams and spillways	4b	Compare given types of dams on given points.	4.2	Gravity dams – Forces acting on dams, typical cross section, Theoretical and practical profiles, Drainage gallery, Joints in gravity dam, High dam and low dam.	CO4
	4c	Suggest suitable measures to prevent seepage through given part of earthen dam and to prevent the given type of dam failure.	4.3	Earthen dams – its components and their function, Typical cross section, Seepage through it, Methods to reduce seepage through embankment and foundation, Methods of construction, types of failure and preventive measures.	
	4d	Select the type of spillways, energy dissipators and gates for the given type of dam with justification.	4.4	Spillways- Definition, function, location and components Types - Emergency and various types of service spillways. Discharge over spillway, Energy dissipation, Spillway with and without gates, Spillway Gates- Radial and Vertical.	
UNIT V: Minor & Micro Irrigation	5a	Draw a layout of given type of bandhara irrigation scheme.	5.1	Bandhara irrigation- Layout, Components, construction and working, solid and open bandhara, Percolation tank – Necessity and selection of site.	CO5
	5b	Compare Weirs and barrages on the basis of given points.	5.2	Weir-component parts, types, Gated Solid Weir- components and construction, Barrages – Components and their functions, Comparison between weir and barrage.	
	5c	Justify the necessity of diversion head work for given situation.	5.3	Diversion head work – necessity, layout of diversion head work with its components and their function.	
	5d	Justify the requirement of lift irrigation under given situation.	5.4	Lift Irrigation- Necessity, Components and their functions, layout.	

U	5e	Prepare a checklist for maintenance of given type of Micro irrigation scheme.	5.5	Micro irrigation - Sprinkler and Drip irrigation- Need, layout of scheme and component parts, maintenance, Merits & demerits, Farm ponds, Jalyukt shivar scheme. Use of IoT for sustainable farming using hydroponics and smart scalable Irrigation	
UNIT VI: Canals	6a	Calculate the balancing depth for the given cross section of canal from the given data.	6.1	Canals-Classification according to alignment and position in the canal network. Typical canal section – Cross section of canal in embankment and cutting, partial embankment and cutting. Balancing depth of canal- simple numerical problems.	CO6
	6b	Design a most economical section for the given type of canal section for given condition.	6.2	Design of most economical canal section- simple numerical problems. Concept of Pipe distribution Network for Irrigation.	
	6c	Suggest suitable material for given type of canal lining with justification.	6.3	Canal lining – purposes, materials used and its properties, advantages of canal lining.	
	6d	Plan the suitable CD work / Canal regulator for given situation.	6.4	Canal CD work-Definition, Types- Aqueduct, siphon aqueduct, super-passage, level crossing-Inlet and outlet, Canal regulators- Head regulator, Cross regulator, Escapes, Falls and Rapids, Canal Outlets.	
	6e	Suggest relevant preventive measures against water logging in given situation.	6.5	Water Logging- its Causes and effects, preventive measures.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Calculate average rainfall for the given area using a) Arithmetic mean method, b) Thiessen polygon method and c) Isohyetal method	2#	CO1
I	2	Mark the contributory area for the given outlet from the given topo-sheet and compute the yield of said catchment area.	2	CO1
II	3	Estimate the crop water requirement for the given data	2#	CO2
II	4	Estimate the capacity of canal for the given data	2#	CO2
III	5	Calculate the reservoir capacity from the given data	2#	CO3
III	6	Calculate control levels for the given data for the given reservoir.	2#	CO3
IV	7	Draw typical cross-section of given type of earthen dam.	2#	CO4
IV	8	Draw the theoretical and practical profile of the given gravity dam section	2	CO4
IV	9	Draw sketch of spillway with gate and energy dissipation arrangement for the given dam section.	2#	CO4
V	10	Draw a labelled sketch of given Gated Solid weir (plan & sectional elevation)	2	CO5
V	11	Draw a labelled sketch of the given Diversion head work, detailed sketch of any one component of it. (Divide wall / Silt excluder / Fish ladder)	2#	CO5
V	12	Prepare detailed report with sketches on the visit to Irrigation structures (e.g., Dam, Weir, Barrage, Canals structures, Percolation tank, Lift irrigation, Sprinkler/Drip irrigation work)	2#	CO5
VI	13	Draw Plan and Sectional elevation of any Canal cross-drainage work i.e., Aqueduct, super passage, level crossing	2#	CO6
VI	14	Design most economical canal section for the given data	2#	CO6
VI	15	Draw typical cross section of canal in Embankment, Cutting and Partial embankment and cutting	2#	CO6
III	16	Prepare report on use of IoT for increasing irrigation efficiency	2#	CO3

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a report of cropping pattern, for the given minor or major irrigation project in your area with reference to growth in yield.

2. Prepare a report on any one executed system of rainwater harvesting with reference to its necessity, broad design parameters, economics in your area along with your comments

3. Conduct online / internet survey for Watershed management project (s) in the Maharashtra State with a detailed report of at least five relevant technical inputs.

4. Summarize the relevant information in the form of the report from internet regarding types of satellite imagery to capture the necessary details of the given water resource projects.

5. Prepare a report on any one executed system of Farm ponds or Jalayukt shivar schemes or drip irrigation scheme with emphasis on its suitability, costing, utility and maintenance after undertaking the visit to it.

6. Visit to the nearby rain gauge station and obtain information for the average rainfall for the particular day.

7. Visit to a drip irrigation installation in your area & write brief report.

8. Prepare a short report on Lift irrigation (Well) based on yield & season wise crops grown.

9. Prepare a model of dam by using locally available material.

10. Prepare a report on the initiatives taken by state government for drip irrigation & sprinkler irrigation.

11. Prepare a report on cooperative equal water distribution system in your area.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Hydrology	6	C	00	08	04	12
			O	02	04	00	6
2	Water requirement of crop	7	C	02	04	06	12
			O	00	04	04	8
3	Reservoir planning	7	C	02	00	10	12
			O	02	04	00	6
4	Dams and spillways	9	C	02	06	04	12
			O	00	04	06	10
5	Minor & Micro Irrigation	9	C	02	04	6	12
			O	00	04	00	4
6	Canals	7	C	02	04	04	10
			O	00	00	06	6
Total		45	C	10	26	34	70
			O	4	20	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	4R2	5R2	6R2	4R2	5	7
2	1U4	1U4	2U4	2U4	3U4			3	5
3	3A4	4U4	5U4	5U4	6U4			3	5
4	1A4	3A4	4A4	5A4	6A4			3	5
5	2A6	3A6	4U6					2	3
6	4A6	5A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing schematic diagram of given irrigation structure.	5
2	Design/ Calculate required parameters.	10
3	Writing report.	5
4	Viva Voce.	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of topic.	5
2	Performance.	10
3	Report writing.	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	-
CO4	3	3	-	-	2	-	-	2	-
CO5	3	3	-	3	2	-	-	2	-
CO6	3	3	-	3	2	-	-	2	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Irrigation and Water Power Engineering	B. C. Punmia, B. B. Pande. Standard Publisher. 16th Edition 2015	10: 9788131807637
2	Irrigation and Hydraulic Structure	S. K. Garg, Khanna Publisher, New Delhi, 2010. 29th Edition 2015	10: 8174090479
3	Irrigation and Water Resources Engineering	G. L. Asawa New Age International, 2006	10: 8122416738
4	Irrigation Engineering	N. N. Basak, Tata McGraw Hill 10thEdition 2007	10: 0074635387
5	Irrigation Engineering	R. K. Sharma, T. K. Sharma, S. Chand and Co.,3rd Edition 2008 Reprint 2015	10: 9788121921282
6	Irrigation Engineering	Sharma R.K. and Sharma T.K, S.Chand and Company Ltd.Delhi, Ed.2002	13: 9788121921282

XV e-References:

1. https://wrd.maharashtra.gov.in/ accessed on 10th Dec. 24
2. https://archive.nptel.ac.in/courses/126/105/126105010/ accessed on 10th Dec. 24
3. https://www.youtube.com/watch?v=fx1uUek3Iqg accessed on 10th Dec. 24
4. https://nptel.ac.in/courses/105105110 accessed on 10th Dec. 24
5. https://www.youtube.com/results?search_query=crop+water+requirement accessed on 10th Dec. 24
6. https://www.youtube.com/watch?v=bDwow2-WzHo accessed on 10th Dec. 24
7. https://archive.nptel.ac.in/courses/126/105/126105019/ accessed on 10th Dec. 24

XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. A. W. Pawde	HOD, Civil Engineering	Government Polytechnic, Nagpur
2	Dr. D.N. Kongre	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Er. G. B. Takey	EE. Vigilance & Quality Control	Public Works Department,Nagpur
4	Dr.Abhay Shende	Principal	JL Priyadarshani College, Nagpur
5	Dr.V.G. Kondekar	HOD, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D.K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE305H
Course Title	:	Environmental Engineering

I Rationale:

Urbanization, industrialization and population explosion detoriates environmental quality. Therefore, it is necessary to ensure safe drinking water, effective waste disposal methods, and a pollution-free environment for maintaining sustainable public health. A civil engineer is required to develop the understanding of the sources, characteristics, purification methods and conveyance system of water supply including the knowledge of domestic sewage disposal and its treatment. This course is intended to develop the basic competencies among the learners about water and wastewater treatments.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Address environmental concerns and design sustainable solutions.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Determine** the water demand for a given city or town.

CO2: **Use** IS 10500 for determination of quality of water.

CO3: **Apply** the water treatment processes for given situation.

CO4: **Select** appropriate distribution system and pipe network for water supply.

CO5: **Interpret** the plumbing system and sewer appurtenances in house drainage.

CO6: **Determine** the wastewater treatment processes for given situation.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Demand of Water	1a	Classify the sources with intake structures of water on the basis of given criteria.	1.1	Sources of water: Surface and Subsurface sources of water. Intake Structures: Definition, types and factors governing the location.	CO1
	1b	Determine demand of water for a given city or town.	1.2	Demand of water: Need to protect water supplies, Demand of water: Definition, Types, Factors affecting, rate and variations in water demands.	
	1c	Determine future population of a city using given data.	1.3	Forecasting of population: Introduction and Methods, (Numerical based on Arithmetical Increase, geometrical increase & Incremental increase only). Design period, estimating of demand of water supply required for city or town.	

UNIT II: Quality of Water	2a	Analyse the water sample from given data.	2.1	Characteristics of water: Need for analysis of water, Physical, Chemical and Biological characteristics of water. Sampling of Water.	CO2
	2b	Use IS 10500 for testing of given water sample.	2.2	Testing of water for Colour, Turbidity, Total solids, hardness, chlorides, Dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds as per I.S. 10500:2012.	
	2c	Determine biological characteristics in water using given data.	2.3	Bacteriological tests, E. coli, B. coli index, MPN. Water quality standards as per I.S. 10500:2012.	
UNIT III: Treatment of Water	3a	Justify the function of given units of water treatment plant.	3.1	Flow diagram of water supply scheme with Water Treatment Plant (WTP), function of units of water supply scheme. Screening: Types, functions and suitability. Aeration: objects and methods of aeration. Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Flash mixure, Jar Test, process of coagulation, types of sedimentation tanks. Clariflocculator: Principle and working with diagram.	CO3
	3b	Compare the types of filters on given points.	3.2	Filtration: Theory of filtration, classification of filters: slow sand filter, rapid sand filter, pressure filter, construction and working of slow sand filter and rapid sand filter.	
	3c	Apply relevent method of chlorination for given situation.	3.3	Disinfection: Objects, methods of disinfection, Chlorination-Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, orthotolidine test.	

	3d	Apply ther elevant technique of water softening, de-fluoridation and advanced treatment for the given sample of water.	3.4	Advanced Water Treatments: Electrolysis, Reverse Osmosis, Water Softening Methods: Need and necessity of Water softening, lime soda process and zeolite process. De-fluoridation techniques.	
UNIT IV: Water Distribution System	4a	Select the relevant mode of conveyance system in the given situation.	4.1	Conveyance of water: Pipes: Types, Choice of materials, Joints in pipes, valves: Types, location and functions.	CO4
	4b	Suggest the water distribution method for the given situation.	4.2	Distribution methods: Gravity, pumping, and combined system, suitability, advantages and disadvantages. Service reservoirs: types and functions.	
	4c	Select the relevant pipe network system for water distribution in the given situation.	4.3	Pipe Network System: Dead end system, grid iron system, circular system, radial system; their suitability, advantages and disadvantages.	
	5a	Select the relevant sanitary fittings to be used at the given location of sanitation system.	5.1	Building Sanitation: Necessity of sanitation, Necessity to treat domestic sewage, Definitions: Sewage, sullage, types of sewage, Rain water pipe, Soil pipe, Sullage pipe, Vent pipe, Building sanitary fittings: Water closet (Indian and European type), flushing cistern, wash basin, sinks, Urinals.Traps: Types, quality and function.	

UNIT V: Building Sanitation	5b	Apply relevant type of plumbing system for the given situation.	5.2	Systems of plumbing: One pipe, two pipe, single stack, choice of system, Principles regarding design of building drainage, layout plan for building sanitary fittings (drainage plan), Inspection and junction chambers: necessity, location, size and shape, Maintenance of sanitary units such as washbasin, sink, traps and chambers.	CO5
	5c	Propose the relevant type of sewerage system for the given situation.	5.3	Systems of Sewerage: Introduction, Types: Separate, Partially Separated and Combined.	
	5d	Select relevant sewer appurtenances in the given situation.	5.4	Sewer Appurtenances: Definition, Types of Sewers. Design of sewers. Self cleansing velocity and non scouring velocity. Laying, Testing and maintenance of sewers. Cleaning of municipal sewers before and after monsoon, Manhole and Drop Manhole: component parts, location, spacing, construction details. Sewer Inlets, Street Inlets.	
atment	6a	Determine the given characteristics of the sewage sample in relation with MPCB norms.	6.1	Analysis of sewage: Characteristics of sewage, D.O., B.O.D., C.O.D. and its significance. Aerobic and anaerobic process, Maharashtra Pollution Control Board (MPCB) Norms for the discharge of treated sewage. Purposes of sewage treatment.	

UNIT VI: Sewage Tre	6b	Justify the function of given units of sewage treatment plant.	6.2	Treatment of Sewage: Flow diagram, Screening, Grit removal, Skimming, Aeration, Sedimentation of sewage, Sludge digestion, Trickling filters, Activated sludge process. Disposal of sewage, Oxidation pond, Oxidation ditch. Septic tank & soak pit: Principle, Construction, Working and Maintenance.	CO6
	6c	Apply various methods of recycle and reuse of waste water to prevent pollution in given situation.	6.3	Recycling and Reuse of domestic wastewater: Necessity, Advantages, Disadvantages, methods and uses.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
II	1	Determine pH value of water sample using digital pH meter.	02#	CO2
II	2	Determine the turbidity of the sample of water using digital Naphelometer.	02#	CO2
II	3	Determine suspended solids, dissolved solids and total solids of a water sample.	02#	CO2
II	4	Determine the dissolved oxygen in a given sample of water using digital D. O. meter.	02#	CO2
II	5	Determine residual chlorine in the sample of water using orthotolodine test.	02#	CO2
II	6	Prepare a report on site visit to the nearby water treatment plant.	02#	CO2
II	7	Determine the optimum dose of coagulant in the given raw water sample by jar test.	02#	CO2
II	8	Prepare a report on the water purifier based on its components and working, (RO purifier).	2	CO2
IV	9	Illustrate various joints used in water supply pipeline through sketches.	2	CO4
V	10	Preparr the sketch of one pipe, two pipe system and layout plan for drainage for a residential building.	2	CO5
VI	11	Determine BOD of a given sample of wastewater.	02#	CO6
VI	12	Determine the dissolved oxygen in the given sample of wastewater.	02#	CO6
VI	13	Determine COD of a given sample of wastewater.	02#	CO6
VI	14	Determine suspended solids in given wastewater sample.	02#	CO6
VI	15	Prepareof a report on a field visit to the wastewater treatment plant.	02#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Collect information regarding a minimum of ten norms for water and wastewater treatment of statutory water bodies.
2. Prepare a report on conventional water treatment processes.
3. Prepare a report on advanced water treatment processes.
4. Prepare a report on conventional wastewater treatment processes.
5. Prepare a report on on advanced wastewater treatment processes.
6. Draw a minimum of four sketches of valves used in the water supply pipeline with their location and function.
7. Prepare a report of a minimum of five pages on the plumbing system for an existing building (G+1 or above) in your campus.
8. Prepare a report of a minimum of five pages on the drainage system for an existing building (G+1 or above) in your campus.
9. Prepare a report on trickling filter.
10. Prepare a report on oxidation pond.
11. Prepare a report on recycle and reuse of wastewater.
12. Collect the water samples from various places and prepare analysis report.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Demand of Water	5	C	04	00	4	8
			O	04	00	00	4
2	Quality of Water	6	C	00	04	06	10
			O	02	04	00	6
3	Treatment of Water	10	C	04	04	06	14
			O	00	04	06	10
4	Water Distribution System	8	C	02	04	06	12
			O	02	00	04	6
5	Building Sanitation	6	C	02	08	00	10
			O	00	04	00	4
6	Sewage Treatment	10	C	02	08	06	16
			O	00	04	06	10
Total		45	C	14	28	28	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	1R2	4R2	5R2	6R2	2R2	4R2	5	7
2	3U4	2U4	3R4	1R4	2U4			3	5
3	1A4	4U4	5U4	3U4	4A4			3	5
4	5U4	6U4	6U4	5U4	6U4			3	5
5	2A6	3A6	3A6					2	3
6	4A6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of equipment	5
2	Performance / Observation	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of equipment	5
2	Performance / Observation	10
3	Calculation, Result, Drawing Graphs (if any)	5
4	Viva Voce	5
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	-	3	-	-	3	-
CO2	3	-	-	2	3	-	2	3	-
CO3	3	2	-	2	3	-	-	3	-
CO4	3	-	-	-	3	-	-	3	-
CO5	3	-	-	-	3	-	-	3	-
CO6	3	2	1	2	3	-	-	3	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Environmental Engineering Vol. I & Vol. II.	B. C. Punmia, Ashok Jain, Arun Jain Laxmi Publications (P) Ltd., New Delhi	13: 9788131805961
2	Water Supply and Sanitary Engineering	Birdie G. S. Birdie, J.S. Dhanpat Rai and Sons, 2011.	10: 81874337954
3	Environmental Engineering	N. N. Basak. McGraw Hill Education India	13: 9780070494633

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3. https://kp.kiit.ac.in/pdf_files/06/SM_5th-Sem_Civil_Water-Supply-Waste-Water-Engineering.pdf. Accessed on 30/08/2024
4. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SAR1202.pdf. Accessed on 30/08/2024
5. https://spintronicbbsr.org/lecturer_notes/CIVIL%20FIFTH%20BY%20URBI%20ROUT.pdf. Accessed on 30/08/2024
6. https://www.scribd.com/document/356435911/Water-Supply-Sanitary-Eng-pdf. Accessed on 30/08/2024
7. https://3.imimg.com/data3/KW/PU/MY-3286169/water-supply-and-sanitary-engineering.pdf. Accessed on 30/08/2024
8. https://www.scribd.com/document/486272808/276914-water-supply-and-sanitary-engineering-by-chittaranjan-bibhar-pdf. Accessed on 30/08/2024

XVI List of Major Equipment/Machineries with Specification:

1. Digital pH meter (4 Digit Display (LED), 0 to 1000 mV, Resolution: 0.01 pH, Manual Temperature, Compensation: 0 to 80 degree C.)

2. Digital Turbidity Meter. (Range 0 to 200 NTU, Resolution 1 NTU, Accuracy: ± 3% FS, ± 1Digit, Display 3½ Digit 7-Segment LED Light Source 6V, 0.3 Amp Tungsten Lamp,Detector: Photodiode, Sample System: 30 mm Clear Glass Test Tubes, Power 230 V ± 10%AC, 50 Hz, Accessories Test tube Set of 5, Operation Manual, Dust Cover.

3. Digital DO meter (Range: 0 to 20 ppm, Resolution: 0.1 ppm, Temperature compensation: 0to 50 degree C).

4. Orthotolidine test kit (free and total chlorine testing for EPA reporting over the range of 0-4mg/L.).

5. Jar Test Apparatus (Digital timer: 1 to 99 minutes, material: Stainless steel, Power: Electricsupply, Range: 25 to 250 rpm, with 6 glass jars of 1000 mL)

6. Electric Oven with digital control (Temperature: 300 degree C, 25 kg capacity).

7. BOD incubator with BOD bottles (Rated Voltage: AC 220V±10% 50Hz, Power: 2800W,Temperature Controlling Mode: Digital Display, Temperature Controlling Point: 24 degreeC, 93.5 degree C, Temperature Controlling Precision: ±0.1 degree C).

8. Digital COD digester (Glassware: 15 Reaction Vessels & Air Condensers, Temperature: 150± 1% degree C, Capacity: 15 Samples at a time, Sample Size: 20 ml, Range: 0 to 500 ppm without dilution, Timer: 2 hours timer with Buzzer, Power Requirement: 230V 1000W

9. Digital Muffle Furnace.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	Head, Civil Engineering	Government Polytechnic, Nagpur
2	Mr. R. M. Walke	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer, Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg, Nagpur
6	Dr. V. G. Kondekar	Head, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSC
Course Code	:	CE306H
Course Title	:	Contracts & Accounts

I Rationale:

Contracts & Accounts is vital for civil engineering students as it bridges the gap between technical execution and project management. Understanding contracts helps students navigate legal frameworks, ensuring projects are legally compliant and risks are minimized. Knowledge of accounts is equally critical, enabling accurate cost estimation, budgeting, and financial tracking. Together, these skills ensure that students can manage projects efficiently, balancing technical demands with financial and legal responsibilities, crucial for successful project completion.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Prepare Contract Document for Civil Enggineering Works

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Apply** relevant type of contract for civil engineering work.

CO2: **Prepare** the typical Tender document for civil engineering work.

CO3: **Apply** procedure to maintain stores and stock accounts

CO4: **Apply** the procedure of maintaining account of materials at site, road metal return,account, imprest cash account and store and stock accounts

CO5: **Prepare** a detailed specification for any given Civil work

CO6: **Prepare** rent fixation and valuation of civil structure.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
70	30	100	40	25	10	25+	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
	1a	Identify the procedure adopted by P.W.D for construction of Civil Engineering Work.	1.1	Administrative approval, Technical sanction, budget provision, expenditure sanction.Methods for carrying out works- contract method, departmental method -rate list method, piece work method, day's work method, employing labours on daily wages basis.	
	1b	Use Indian Contract Act to prepare a Contracts Documents.	1.2	Definition of contract, objects of contract, requirements of contract, overview of Indian Contract Act.	

UNIT I: Contracts	1c	Distinguish the given types of contract.	1.3	Types of engineering contract with advantages, disadvantages and their suitability - Lump sum contract, item rate contract, percentage rate contract, cost plus percentage, cost plus fixed fee, cost plus variable percentage and cost plus variable fee contract, labour contract, demolition contract, target contract, negotiated contract, Engineering Procurement Construction Contract (EPC), Annuity Contract.	CO1
	1d	Identify the provision of FIDIC contract relevent to given situation.	1.4	Introduction of FIDIC Conditions of contract.Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor.	
	1e	Justify the importance of Build Operate Transfer (BOT) contract in given Situation.	1.5	Build Operate Transfer (BOT) Project, BOT Toll contract, BOT (Annuity) contract, Design, Build, Finance, Operate and Transfer (DBFOT) contract, Hybrid Annuity contract, Operate Maintain and Transfer (OMT) contract, Operation & Maintenance contract (Introduction only).	
	2a	Apply the e-tendering process, including the online submission and opening of technical and financial bids.	2.1	Definition of tender, necessity of tender, types of tender-Local, Global, Limited. E -Tendering System – Online procedure of submission and opening of bids (Technical and Financial).	

UNIT II: Tender & Tender Documents	2b	Draft a tender notice for the given type of work.	2.2	Notice to invite tender (NIT)- Points to be included while drafting tender notice,drafting of tender notice. Procedure of submitting filled tender Documents (Two envelope system), procedure of opening tender, comparative statement, scrutiny of tenders, award of contract, letter of award	CO2
	2c	Identify the relevent provision of Contract in the given situation as per Contract act 1872.	2.3	Tender documents – Index, tender notice, general instructions, special instructions, Schedule A, Schedule B, Schedule c etc.Terms related to tender documents – contract conditions- time limit, time extension, penalty, defective material and workmanship, termination of contract, suspension of work,subletting of contract, extra items, price variation clause(escalation), defect liability Period, liquidated Damages.	
	2d	Apply the principles of arbitration, including the appointment of arbitrators, etc provided by the Arbitration and Conciliation Act.	2.4	Arbitration- Meaning, Qualification of an arbitrator, Appointment, Dispute and Settlement of disputes, Arbitration and Conciliation Act, Arbitration award.	
	3a	Use various account forms for billing purpose..	3.1	Various account forms and their uses – Measurement Books, E- Measurement book (E-MB), Nominal Muster Roll(NMR), Imprest Cash, Indent, Invoice, Bill, Vouchers, Hand receipt Cash Book, Temporary Advance. Heads of Accounts	

UNIT III: : Store & Stock Account	3b	Distinguish various modes of payment to contractors.	3.2	Mode of Payment to the contractor and its necessity - Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E - Payment.	CO3
	3c	Classify Store & Stocks in diifferent Categories.	3.3	Meaning of store and stock, Classification of stores a) General store and stock b) Tools and Plants c) Inflammable Materials d) Road Metals	
	3d	Apply the account procedures for managing stores including all for given work.	3.4	Account procedure of stores, procedure for purchase of store materials, safe custody of stores. Indent for issue of materials, issue rate, unstamped receipt, sales and write off stores.	
	3e	Identify the method of issue of material on indent, issue rate, unstamped receipt, sales and write off stores.	3.5	Stock accounts, reserve stock limit, physical verification of stock, Indemnity bond, Credit note.	
urn	4a	Apply the various forms used for register of MAS.	4.1	Meaning of Material at Site Accounts forms used for register of Materials at Site Account, Form no.35- Detailed statement of materials compared with estimated requirements, Form no.37- Reporting the value and verification of unused materials.Form no.38- Statement showing disposal of unused material at site	

UNIT IV: Material at site Account & Road metal ret	4b	Distinguish the procedure for disposing of surplus materials.	4.2	Salient Features of material at site accounts, Issue of materials to contractors, Accounts of material directly charge to work site, Disposal of surplus materials.	CO4
	4c	Analyze the circumstances under which materials are charged directly to work.	4.3	Circumstances under which the material charged directly to work Case-I- The material issued in a small quantity and when the work done departmentally. Case-II- The material issued in huge and large quantity and reserved stock limit is over. Case-III- When the work is donethrough contractor on labour basis.	
	4d	Identify the uses of Forms in documenting and managing road construction materials and processes.	4.4	Meaning of road metal return, uses of form no.16, form no.16/16A and Form no. 17.	
	4e	Apply the rules for maintaining , manage and document shortages and surpluses of road metal in construction projects.	4.5	Rules of maintaining the road metal return, shortage and surplus road metal.	
pecifications	5a	Draft the specifications for the given type of an item.	5.1	Necessity and importance of specifications of an items, points to be observed in framing specifications of an item	CO5
	5b	Propose the specifications for the construction of the given item of work.	5.2	Types of specification - Brief and Detailed, Standard and Manufacturers Specification.	

UNIT V: Sl	5c	Formulate the detailed specifications for the given item of irrigation work.	5.3	Preparing Detailed Specifications of items in civil engineering works from each of following- Building construction, Irrigation Engineering , Transportation Engineering , Public health Engineering	
UNIT VI: Real Estate Valuation	6a	Identify the purpose of valuation of the given structure in the given situation.		Definition and purpose of Valuation, role of valuer. Definition - Cost, Price and Value, Characteristics of Value, Factors Affecting value	CO6
	6b	Calculate monthly rent of given residential building.		Fixation of rent, Lease – types of lease, lease hold property and free hold property. Mortgage – Mortgage deed, precautions to be taken while making mortgage.	
	6c	Identify various type of valuation in real estate development.		Real Estate Development and Construction Valuation,Cost Approach vs. Income Approach,Construction Cost Estimation,Market Valuation of Developed Properties	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Prepare a report on Uses the relevant format for initiating the given works	2	CO1
I	2	Prepare contract documents of the given project.	2#	CO1
II	3	Draft the Tender notice for the given type of construction work. Draft the Tender notice for the given type of construction work tobe executed by adopting the rocess of E-tendering.	2#	CO2
II	4	Interpret the given set of tender document to comment on the components reflected in it.	2	CO2
II	5	Interpret the conditions and data furnished for E-tendering of the given project.	2#	CO2
II	6	Prepare a E-Tender and Evaluate it	2#	CO2
II	7	Form a group of five students on the basis of detailed estimate provided/collected by teacher/student & Prepare Tender document for the given civil engineering	2	CO2
II	8	Interpret the given case study on, 'Contract litigation resolution through arbitration' and submit your comments.	2#	CO2
III	9	Record the measurements in the prescribed format of measurement book for the given items of works with abstract,completion certificate for payment.	2#	CO3
III	10	Prepare R.A bills, First and final bills, Forms of bill, voucher.	2#	CO3
IV	11	Collect the various account forms stated below from P.W.D and writing on it. a) Ruling the forms of Nominal Muster Roll (All three parts) b) Measurement Book c) Daily Labour Report d) Rate list e) Hand Receipt f) Form of Material at Site Account g) Road Metal Return Account h) Form of Imprest i) Form of Indent for issue of materials	2#	CO4

V	12	Draft Detailed specification for following items - a)P.C.C. bed concrete for foundation b)U.C.R.masonry in foundation and plinth c)Burnt brick masonry in CM in superstructure. d)RCC work M20 grade. e)Internal plaster in CM.	2#	CO5
V	13	Draft Detailed specification for one item from each of the following system a) Irrigation Engineering. b)Transportation engineering. c)P.H. En ineerining	2#	CO5
VI	14	Determine the valuation of a given structure and submits the valuation report in prescribed formats	2#	CO6
VI	15	Determine the monthly rent of the given building/quarter as per PWD method/norms.	2#	CO6

Note # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a brief summary on procedure of opening of tenders.
2. Prepare a brief summary on procedure of filling e- tender
3. Prepare report on BOT type contract works executed at nearby location.
4. Prepare report on procedure of registration as a contractor in different organizations.
5. Prepare report on procedure of Indent and Invoice at the site.
6. Prepare report on GST procedure in construction project
7. Prepare a sample invioce, running account bills & final bills for the given projects.
8. Prepare a bill of Quantities for given Construction drawing.
9. Draft a Detailed Contract with payment Schedule.
10. Prepare a financial Management of given Construction Contracts .

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Contracts	10	C	2	4	6	12
			O	0	0	6	6
2	Tender & Tender Documents	10	C	2	8	6	16
			O	2	4	4	10
3	Store & Stock Account	6	C	2	4	4	10
			O	0	4	4	8
4	Material at site Account & Road metal return	6	C	-	4	4	8
			O	0	4	0	4
5	Specifications	5	C	2	4	6	12
			O	0	4	0	4
6	Real Estate Valuation	8	C	2	4	6	12
			O	2	0	6	8
Total		45	C	10	28	32	70
			O	4	16	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	5R2	6R2	2R2	6R2	5	7
2	1U4	2U4	2U4	2U4	2A4			3	5
3	3U4	3A4	6U4	3A4	3U4			3	5
4	4U4	4A4	3U4	5U4	4U4			3	5
5	1A6	2A6	1A6					2	3
6	5A6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Draft a tender notice/ Prepare a contract documents	10
2	Performance	10
3	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Report writing	15
2	Performance	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	1	2	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	2	-
CO6	3	-	-	-	-	-	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Estimating, Costing, Specification & Valuation in Civil Engineering	M. Chakraborti, Chakraborti Publishers, 2006	13:9788174767295
2	Contracts and Accounts (Estimating and Costing)	S.C. Rangwala, Charotar Publishers, 2023	13:9789385039310
3	Civil Engineering Contracts and Estimates	B.S. Patil, University press, 2015	13:9788193976405
4	Contracts and Accounts for Civil Engineers	A.K. Upadhyay, S.K.Kararia & Sons Publishers, 2018	13:9789382332803
5	Valuation of Real Properties	S.C. Rangwala, Charotar Publishers, 2023	13:9789385039075

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2. https://youtu.be/S4wSNBt9vq8?si=zMoRq6EPcZziKTYl , Assess on 30/12/24
3. https://youtu.be/gwL8HNlLvhw?si=vt-7EsHHIy_nWyPe ,Assess on 30/12/24

XVI List of Major Equipment/Machineries with Specification:

1. ---

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr.D.K.Parbat	HOD in Civil Engineering	Government Polytechnic, Nagpur
2	Mr.V.B.Dhait	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
3	Mrs. N.K.Deshmukh	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Dr.D.K.Kondekar	HOD in Civil Engineering	Government Polytechnic, Sakoli
5	Dr.Abahy Shende	HOD in Civil Engineering	Priyadarshini College of Engineering,Nagpur

(Dr. D.K.Parbat)
HOD & Chairman PBOS,

(Dr. G. V. Gotmare)
Member Sectretary PBOS,

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSE
Course Code	:	AM302H
Course Title	:	Advanced Concrete Technology

I Rationale:

Advanced concrete technology involves innovative materials and techniques to enhance concrete's durability, strength, and sustainability. It integrates nano-materials, self-healing capabilities, and high-performance mixes to meet modern construction demands. This technology reduces environmental impact, increases lifespan, and supports the development of resilient, efficient infrastructure, essential for future urbanization and environmental challenges.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Design concrete mixes for different purposes, including strength, durability and workability requirements.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Design** quantities of materials for concrete mix proportion.

CO2: **Use** the proper admixture for concrete.

CO3: **Select** special concrete according to the nature of work and site conditions.

CO4: **Use** appropriate Precast Concrete member.

CO5: **Use** Prestressed Concrete member at appropriate place.

CO6: **Appraise** Special Processes of concrete

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70	100	40	25	10	25	10	25	10

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Concrete mix Proportioning	1a	Describe factors governing mix proportioning in given situation with justification.	1.1	Introduction, factors affecting choice of mix proportion.	CO1
	1b	Compare given methods of mix proportioning.	1.2	Methods of concrete mix design, IS method, trial and adjustment method, ACI method, rapid method, computer aided mix design. Comparison of methods. Use of IS 10262 - 2019.	
	1c	Calculate quantities of materials for a given grade of concrete.	1.3	Mix design of ordinary, standard and high strength concrete. Calculater quantities of materials for mix proportioning using IS: 10262 (2019).	
	2a	Classify given admixtures with justification.	2.1	Definition of admixtures, functions of admixtures. Use of IS: 9103 (2018).	

UNIT II: Concrete Admixtures	2b	Choose proper admixture for a given conditions.	2.2	Types of admixtures, accelerators, retarders, air entraining and water reducing. plasticizers, super plasticizers, hyper plasticizers, special admixtures, uses of admixtures.	CO2
	2c	Describe properties of given pozzolanic admixtures with justification.	2.3	Physical properties of pozzolanic materials like fly ash, rice husk ash, Metakaolin, silica fume and natural pozzolana.	
	2d	Compare given types of concrete.	2.4	Ecological concept behind using flyash, advantages & disadvantages of pozzolana concrete, properties of concrete influenced by pozzolana.	
UNIT III: Special Concrete	3a	Select given type of concrete for different situations.	3.1	Properties, ingredients required, advantages & disadvantages of- Light weight concrete, Lightweight aggregate concrete & foamed concrete, Autoclaved aerated concrete, No fines concrete, High strength concrete, Refractory concrete, High density & radiation shield concrete, Polymer concrete, Fibre reinforced concrete, self compacting and roller compacted concrete. Applications of special concretes.	CO3
	3b	Describe use of ready-mix concrete in given situation with justification.	3.2	Definition of ready mixed concrete (RMC), types of plants, truck mixer efficiency, transit duration, effect of prolonged agitation, quality control acceptance and compliance. Guidlines as per IS 4926 (2003) for RMC Applications, advantages and disadvantages of RMC. Concept of W/C ratio.	

UNIT IV: Precast Concrete	4a	Describe manufacture of given precast concrete member and process.	4.1	Definition of precast concrete, process diagram showing manufacture of precast products, layout of plant for manufacture of precast products, review of small and large products.	CO4
	4b	Compare precast concrete with given other concrete on given points.	4.2	Special formwork requirements, methods of compaction, curing and handling of components. Application, advantages & disadvantages of precast concrete. Gidelines as per IS: 15916 (2011) for precast concrete.	
UNIT V: Prestressed Concrete	5a	Compare pre-stressed concrete with given other concrete on given points.	5.1	Definition of pre-stressed concrete, concept of pre-stress, material requirement, methods of pre-stressing, losses in pre-stress, simple numerical. Application, advantages & disadvantages of prestressed concrete. Use of IS: 1343 (1980).	CO5
UNIT VI: Special Processes	6a	Describe given types of special processes of concrete with justification.	6.1	Sprayed concrete, Underwater concreting, Grouting, Slip-form construction, Prefabricated concrete, Pumping concrete, Vacuum concrete process. Use of IS: 456 (2000)	CO6
	6b	Choose type of surface coating for a given condition.	6.2	Introduction and selection of various concrete coating and surface treatments.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Design a concrete mix design using IS method (Part I). Testing of cement.	2#	CO1
I	2	Design a concrete mix design using IS method (Part II). Testing of metal.	2#	CO1
I	3	Design a concrete mix design using IS method (Part III). Testing of sand.	2#	CO1
I	4	Design a concrete mix design using IS method (Part IV). Casting of concrete cubes.	2#	CO1
I	5	Design a concrete mix design using ACI method (Part I). Testing of cement.	2#	CO1
I	6	Design a concrete mix design using ACI method (Part II). Testing of metal.	2#	CO1
I	7	Design a concrete mix design using ACI method (Part III). Testing of sand.	2#	CO1
I	8	Design a concrete mix design using ACI method (Part IV). Casting of concrete cubes.	2#	CO1
II	9	Compare compressive strength of concrete using admixtures (Part I). Testing of cement.	2#	CO2
II	10	Compare compressive strength of concrete using admixtures (Part II). Testing of metal and sand.	2#	CO2
II	11	Compare compressive strength of concrete using admixtures (Part III). Casting of concrete cubes.	2#	CO2
III	12	Prepare a report on visit to RMC plant.	2#	CO3
IV	13	Prepare a report on visit to Precast concrete plant.	2	CO4
V	14	Prepare a report on visit to Prestressed concrete site.	2	CO5
VI	15	Prepare a report on visit to Special process of concrete.	2	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a layout of comparision of methods of Mix Design.
2. Prepare a layout of advantages & disadvantages of pozzolona concrete.
3. Collect various types of admixtures and prepare a report.
4. Prepare microproject on special concrete.
5. Prepare a layout of flow diagram for RMC plant.
6. Prepare a layout for plan layout for a precast unit.
7. Prepare microproject on precast concrete.
8. Prepare a chart showing stages of Pre-tensioning.
9. Prepare a chart showing anchorage systems in post tensioning.
10. Prepare a microproject on special processes in concrete.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Concrete mix Proportioning	9	C	02	00	12	14
			O	04	04	00	8
2	Concrete Admixtures	8	C	00	06	08	14
			O	02	00	06	8
3	Special Concrete	8	C	02	04	06	12
			O	00	04	04	8
4	Precast Concrete	7	C	04	04	04	12
			O	00	00	06	6
5	Prestressed Concrete	7	C	02	04	04	10
			O	02	04	00	6
6	Special Processes	6	C	04	04	00	8
			O	00	04	00	4
Total		45	C	14	22	34	70
			O	8	16	16	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	3R2	5R2	1R2	6R2	6R2	2R2	5R2	5	7
2	6R4	4R4	5U4	1R4	3U4			3	5
3	4A4	5A4	2A4	5U4	6U4			3	5
4	2A4	3U4	4U4	1U4	3A4			3	5
5	2U6	3A6	4A6					2	3
6	1A6	1A6	2A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing figure/diagram, selection of equipment, writing procedure etc.	5
2	Collection of data/compilation, performance.	10
3	Calculaton, result, conclusion.	5
4	Viva voice	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Collection of data.	5
2	Report writing/Poster preperation.	10
3	Calculation/result.	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	2	3	-	3	2	-
CO2	3	2	2	2	3	-	3	2	-
CO3	3	-	2	2	3	-	3	-	-
CO4	3	-			3	-	3	-	-
CO5	3	-			3	-	3	-	-
CO6	3	-			3	1	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Concrete Technology	M. L. Gambhir, Tata Mc Graw Hill, Fifth Edition, 2013	13 :9781259062551, 10 :1259062554
2	Concrete Technology	M. S. Shetty, S.Chand and Co, First Edition, 2005	13 :9788121900034, 10 : 8121900034
3	Concrete Technology	S. Bhavikatti, I K International Publishing House Pvt. Ltd, First Edition, 2015	13 :9789384588670, 10 : 9384588679
4	Concrete Technology	A.M. Neville & J.J. Brooks. Pearson Education, First Edition, 2002	13 :9788131705360, 10 : 8131705366
5	Concrete Technology	A.R. Santhakumar, Oxford University Press, First Edition, 2006	13 :9780195671537, 10 : 0195671538
6	IS 383: 1970 Specification for coarse and fine aggregate from natural sources	Bureau of Indian Standards	
7	IS 456: 2000 Code of practice for plain and reinforced concrete (Fourth revision)	Bureau of Indian Standards	

XV e-References:

1. https://youtu.be/7tHrG98Mmug accessed on 26/08/2024
2. https://youtu.be/bHT1SySn6z4?list=TLPQMjMwMTIwMjKRYE5-awUKmA accessed on 26/08/2024
3. https://youtu.be/eJ1kIO4JfSo , accessed on 26/08/2024
4. https://youtu.be/zNmzS6OOMFA , accessed on 26/08/2024
5. https://www.youtube.com/watch?v=xNj3-1mbXt0 , accessed on 26/08/2024

XVI List of Major Equipment/Machineries with Specification:

1. Concrete mixer.
2. Table vibrator.
3. IS seive set for coarse aggregate.
4. IS sieve set for fine aggregate.
5. Vicats apparatus.
6. Mortor cube vibrator.
7. Compression testing machine.
8. Aggregate impact testing machine.
9. Slump cone.
10. Compaction factor test apparatus.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Mr. R. D. Dongarwar	Lecturer in Applied Mechanics	Govt. Polytechnic, Nagpur
2	Mr. H. L. Wahane	Lecturer in Applied Mechanics	Govt. Polytechnic, Nagpur
3	Mr. A. A. Azher	Lecturer in Applied Mechanics	Govt. Polytechnic, Nagpur
4	Er. G. B. Takey	Retd. EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg. Nagpur
6	Dr. V. G. Kondekar	Head, Civil Engineering	Govt. Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	DSE
Course Code	:	AM303H
Course Title	:	Advanced Design of Structures

I Rationale:

Advanced structural design in civil engineering focuses on creating safe, resilient, and sustainable infrastructure. By utilizing innovative materials, computational modeling, and modern construction methods, it addresses challenges like climate change, urbanization, and resource constraints. This approach ensures structures meet high standards for durability, efficiency, and environmental impact, benefiting society long-term.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Design concrete and steel structures for civil infrastructure.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Design** the steel tension members under different loading conditions.

CO2: **Design** the steel compression members under different loading conditions.

CO3: **Design** the doubly reinforced rectangular RCC beams under different loading conditions.

CO4: **Design** the flanged RCC beams under different loading conditions.

CO5: **Design** waist slabs of RCC Dog legged staircase.

CO6: **Design** the circular columns and the isolated RCC rectangular column footings.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
3	-	2	1	6	3

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
30	70 $	100	40	25	10	25#	10	25	10

$ 4 Hours duration

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Design of Steel Tension Members	1a	Draw given type of the steel section.	1.1	Types of sections used for Tension members.	CO1
	1b	Determine the capacity of the given tension member for given end connection.	1.2	Strength of tension member, net cross-section.	
	1c	Design the given tension member for the given situation from the specified data.	1.3	Design of axially loaded single angle and double angle tension members with bolted and welded connections.	
embers	2a	Suggest the type of the given steel sections that can be used as a compression member with justification.	2.1	Types of sections used as compression member. Calculation of effective length, radius of gyration and slenderness ratio. Permissible values of slenderness ratio as per IS: 800 (2007).	

UNIT II: Design of Steel Compression M	2b	Design the given compression member for the specified situation from the given data.	2.2	Strength of axially loaded single and double angle struts connected by bolted and welded connections with gusset plate only. Limits of width to thickness ratios to prevent local buckling.	CO2
	2c	Draw the sketches the single and double lacing system for the given built up columns of the specified structure.	2.3	Design of axially loaded single angle and double angle compression members with bolted and welded connections.	
	2d	Draw with sketch the battening system for the given built up columns of the given structure.	2.4	Introduction to built up sections, lacing and battening (Meaning and purpose). Diagrams of single and double lacing and battening system. (No numerical problems)	
UNIT III: Analysis and Design of Doubly Reinforced Rectangular Concrete Sections	3a	Check the given section for its use as doubly or singly reinforced section from the given data.	3.1	Meaning and conditions for providing doubly reinforced beam.	CO3
	3b	Calculate the Young's modulus for the given parameters of the specified doubly reinforced beam.	3.2	Stress in steel (fsc) for different values of d'/d ratio.	
	3c	Determine ultimate moment of resistance of doubly reinforced beam from the given data.	3.3	Analysis of doubly reinforced section, strain and stress diagrams, numerical problems on ultimate moment of resistance of a doubly reinforced beam.	
	3d	Design reinforcement for the given doubly reinforced beam.	3.4	Design of doubly reinforced sections for given size and loading, calculation of Ast and Asc only.	
sign of Flanged ms	4a	Determine the effective flanged width and reinforcement for the specified section for its use as a flanged section from the given data.	4.1	Meaning and conditions for formation of flanged (T and L) beams as per IS 456:2000, comparison with rectangular beams, effective width of flange.	

UNIT IV: Analysis and De Concrete Bea	4b	Compute ultimate moment of resistance of the given flanged section.	4.2	Analysis of singly reinforced flanged beams having neutral axis in flange or web. Determination of Moment of Resistance.	CO4
	4c	Calculate Ast required for the specified flanged beam for case of neutral axis lying in the flange from the given data.	4.3	Determination of reinforcement in a singly reinforced flanged beam for the given dimensions. (Neutral axis lies in flange only).	
UNIT V: Design of RCC Staircase Slab	5a	Calculate different loads on the waist slab of the given dog legged staircase from the given data.	5.1	Various clauses in IS456-2000 regarding effective span and load calculation for typical flight of a dog legged staircase.	CO5
	5b	Design the waist slab of the given dog legged staircase from the given data.	5.2	Live load on staircase of different types of buildings such as residential, office, commercial, public, factory etc.	
	5c	Draw reinforcement detailing diagram for the flight from the given data of the given dog legged staircase.	5.3	Load calculation for a typical flight of a dog legged staircase with load distribution on landing slab as per IS 456-2000.	
	5d	Determine the live load for the given type of the building.	5.4	Design of waist slab of a dog legged staircase for given rise, tread, width, and number of steps, with supporting beams at the ends of flight, parallel to steps. Reinforcement detailing of typical flight of dog legged staircase.	
C Circular Column and ar Footing	6a	Design the given axially loaded short circular column with spiral ties for the given data.	6.1	Introduction to rectangular and circular columns and related codal provisions in IS:456-2000.	CO6
	6b	Design the given isolated rectangular footing for given rectangular column for flexure from the given data.	6.2	Procedure and numerical problems on design of axially loaded short rectangular and circular columns with lateral and spiral ties.	

UNIT VI: Design of RC Rectangul	6c	Draw the reinforcement detailing for the specified type of footing from the given data.	6.3	Introduction to various types of RCC footings like isolated, stepped and sloped footings, combined footings, piles, raft, eccentric footing.	CO6
	6d	Determine the load on the given axially loaded short column of the specified structure.	6.4	Design of isolated rectangular footing of uniform depth, flexural design with checks for one-way shear, two-way shear and bond.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Determine the effective length of the given compression member for various configurations under different end conditions with neat sketches.	2	CO1
I	2	Design and draw a tension member for the given situation.	2#	CO1
II	3	Design and draw a compression member for the given situation.	2#	CO2
II	4	Draw sketches for single & double lacing of given built up columns.	2	CO2
II	5	Draw sketches for battening of given built up columns.	2#	CO2
III	6	Design and draw a doubly reinforced RCC beam for given data.	2#	CO3
IV	7	Design and draw a flanged RCC beam for given data.	2#	CO4
IV	8	Draw reinforcement details of the flanged RCC beam designed in Pr.No.7	2#	CO4
V	9	Draw the neat sketches of different staircases used in your institute building mentioning its type, tread, rise, thickness of waist slab.	2	CO5
V	10	Design and draw the waist slab of dog legged staircase for the given data.	2#	CO5
V	11	Draw reinforcement details of waist slab for typical flight of a dog legged staircase designed in Pr.No.10.	2#	CO5
VI	12	Design and draw a circular column with spiral ties for the given situation.	2#	CO6
VI	13	Design and draw the isolated rectangular footing of uniform depth for the given situation.	2#	CO6
VI	14	Draw reinforcement details of the isolated rectangular footing designed in Pr.No.13.	2#	CO6
VI	15	Interpret the given RCC structural drawings with reference to reinforcement details of various structural elements.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a poster showing types of tension members.

2. Design a tension member for a roof truss and prepare report.

3. Prepare a poster showing types of compression members.

4. Design a compression member for a roof truss and prepare report.

5. Prepare a poster for maximum neutral axis, percentage steel and limiting moment of resistance for various grades of steel and concrete.

6. Prepare a poster showing stress block diagram for singly reinforced and doubly reinforced beam.

7. Prepare a poster showing stress block diagram for a T-beam with N.A. within the flange and N.A. within the web.

8. Draw a poster showing L-section and X-section showing details of reinforcement in a T-beam.

9. Prepare a poster for various clauses in IS 456-2000 regarding effective span and load calculation for typical flight of a dog legged staircase.

10. Prepare a poster showing reinforcement detailing for dog legged staircase.

11. Prepare a poster showing related codal provisions in IS:456-2000 for rectangular footings and circular columns.

12. Prepare a poster showing types of RCC footings like isolated, stepped and sloped footings, combined footings, piles, raft, eccentric footing.

13. Prepare a poster showing reinforcement detailing for rectangular footing.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Design of Steel Tension Members	6	C	2	4	4	10
			O	0	0	6	6
2	Design of Steel Compression Members	8	C	2	4	6	12
			O	0	4	4	8
3	Analysis and Design of Doubly Reinforced Rectangular Concrete Sections	9	C	4	4	6	14
			O	0	4	4	8
4	Analysis and Design of Flanged Concrete Beams	6	C	2	4	4	10
			O	0	4	0	4
5	Design of RCC Staircase Slab	6	C	0	4	6	10
			O	2	4	0	6
6	Design of RCC Circular Column and Rectangular Footing	10	C	0	8	6	14
			O	2	0	6	8
Total		45	C	10	28	32	70
			O	4	16	20	40

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

Q. No.	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Options	
	TLM	TLM	TLM	TLM	TLM	TLM	TLM	C	O
1	1R2	2R2	3R2	3R2	4R2	5R2	6R2	5	7
2	1U4	1A4	2U4	2U4	2A4			5	7
3	3U4	4U4	4A4	4U4	4A4			5	7
4	5U4	6U4	6U4	4U4	5U4			5	7
5	2A6	3A6	1A6					2	3
6	5A6	6A6	6A6					2	3

*T- Unit/Topic Number L- Level of Question M- Marks
*R – Remember U – Understand A – Analyze / Apply
*1R2 means Unit Number No- 1, Level of Question –Remember, Marks – 2 Marks

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Drawing figure/diagram, writing procedure etc.	5
2	Performance	10
3	Calculation, Result	5
4	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Collection of data	5
2	Report writing/Poster preperation	10
3	Calculation/ result	10
	TOTAL	25

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	-	-	-	3	-	-
CO2	3	3	3	-	3	-	3	-	-
CO3	3	3	3	-	-	-	3	-	-
CO4	3	3	3	-	3	-	3	-	-
CO5	3	3	3	-	3	-	3	-	-
CO6	3	3	3	-	3	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Design of Steel Structures	Dayarathnam P. S. Chand and Company, Delhi, 2012	13: 978-8121923200
2	Design of Steel Structures	Sairam, K.S. Pearson Publication, Delhi, 2015	13: 9332516308
3	Fundamentals of Reinforced Concrete	Sinha N.C. Roy S.K. S. Chand and Co., New Delhi, 2007.	13: 978-8121901277
4	Reinforced Concrete Design Principles and Practice	Krishna Raju, N.Pranesh, R.N. New Age International, umbai,2018	13: 978-8122414608
5	Reinforced concrete Design	Pillai, S.U. Menon, Devdas McGraw Hill Publications, New Delhi,2017	13:978-0070141100
6	Limit State Design of Reinforced Concrete	Varghese, P. C. PHI Learning Private Limited, Delhi, 2008	13:978-8120320390
7	IS 800-2007 Indian Standard code of practice for use of structural steel in	BIS, New Delhi	--

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2. https://www.youtube.com/watch?v=l20kF6fhScA&feature=player_detailpage assessed on 12th December 2024.
3. https://www.youtube.com/watch?v=RJXJpeH78iU&feature=player_detailpage assessed on 12th December 2024.

XVI List of Major Equipment/Machineries with Specification:

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Shri. R. D. DONGARWAR	LECTURER	Govt. Polytechnic, Nagpur
2	Shri. H. L. Wahane	LECTURER	Govt. Polytechnic, Nagpur
3	Shri. A. A. AZHER	LECTURER	Govt. Polytechnic, Nagpur
4	Er. G. B. Takey	Retd. EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engg. Nagpur.
6	Dr. V. G. Kondekar	Head, Civil Engineering	Govt. Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE
Course Category	:	SEC
Course Code	:	CE352H
Course Title	:	Capstone Project

I Rationale:

The Capstone Project curriculum bridges academic theory with practical application, offering diploma engineering students real-world experience in project planning, execution, and analysis. By engaging in teamwork and problem-solving, students apply technical knowledge, innovate solutions, and develop essential skills in technical communication through detailed report writing. Professional presentation practice builds confidence and clarity, preparing students to effectively convey and defend their work. This curriculum fosters adaptability, critical thinking, and self-directed learning, equipping students with the competencies necessary for success in engineering roles within industry or further academic study.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Apply critical thinking and problem solving skills to engineering challenges.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Develop** a feasible project proposal addressing relevant engineering problem(s).

CO2: **Plan** and organize project activities, including timeline, resource allocation, and budgeting.

CO3: **Compile** a literature review and methodology relevant to the project.

CO4: **Execute** project tasks systematically to achieve desired engineering outcomes.

CO5: **Test,** troubleshoot, and refine project components to ensure accuracy of results.

CO6: **Prepare** and present project report, effectively communicating goals, methodology, and results.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	4	-	4	2

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	50	20	50+	20	-	-

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
UNIT I: Proposal	1	Form project teams of four to five students, as per the guidelines of your program.	2#	CO1
	2	Conduct initial survey to identify a relevant engineering problem and define the problem scope, objectives, and key challenges.	2#	CO1
	3	Hold team brainstorming sessions to explore potential approaches and solutions and evaluate each approach's feasibility and effectiveness in addressing the problem.	2#	CO1
	4	Analyse project requirements: materials, technology, cost, time, and human resources and identify potential risks and develop mitigation strategies.	2#	CO1
	5	Present the preliminary proposal to the project guide and revise the proposal based on feedback, refine the problem statement and solution approach (if required).	2#	CO1
	6	Prepare a formal proposal document in prescribed format and submit it for approval by the mentor (project guide).	2#	CO1
	7	Create a Gantt chart or project schedule outlining major tasks, milestones, and deadlines and set target dates for each phase, considering project scope.	2#	CO2

UNIT II: Planning	8	Identify the necessary tools, equipment, materials, and software for project completion and assign team members to tasks based on skill sets and project needs.	2#	CO2
	9	Calculate costs for materials, equipment rentals, software licenses, and miscellaneous expenses and set a budget for each phase of the project to ensure cost-effective planning.	2#	CO2
	10	Estimate the required hours for each team member based on project needs and timelines and monitor resource usage throughout the project to stay within budget and schedule.	2#	CO2
UNIT III: Liturature Review	11	Search for academic papers, industry reports, and case studies related to the project topic and analyse collected resources and summarize findings, noting insights that inform project design.	2#	CO3
	12	Evaluate existing research to identify areas that lack sufficient study or solutions and define how the project will address these gaps and contribute new insights.	2#	CO3
	13	Choose appropriate methods for data collection, experimentation, or analysis to achieve project objectives and justify the chosen methodology based on similar studies and project requirements.	2#	CO3
	14	Compile a written review summarizing relevant literature, key insights, and the project's methodological approach and submit the literature review and methodology for mentor feedback and revision.	2#	CO3
Execution	15	Divide the project into specific, manageable tasks aligned with the project plan and assign each task to team members according to skill and expertise.	2#	CO4
	16	Begin hands-on work, such as prototyping, coding, or constructing components, according to the project methodology and ensure all steps align with technical requirements and desired outcomes.	2#	CO4
	17	Continue project task.	2#	CO4
	18	Continue project task.	2#	CO4
	19	Continue project task.	2#	CO4

UNIT IV:	20	Continue project task.	2#	CO4
	21	Continue project task.	2#	CO4
	22	Continue project task.	2#	CO4
	23	Regularly review each task's progress to ensure alignment with specifications and quality standards and use checklists or logs to document completion and quality of each task.	2#	CO4
	24	Record steps taken, materials used, results, and any challenges faced in a project log and ensure all documentation is clear for future reference or report preparation.	2#	CO4
UNIT V: Testing	25	Perform functionality tests on individual components or subsystems to identify any issues and compare test results against expected outcomes to assess accuracy.	2#	CO5
	26	Apply systematic troubleshooting techniques to isolate the root causes of errors (if any) and modify component settings, recalibrate, or replace parts if needed to resolve issues.	2#	CO5
	27	Prepare detailed records of testing procedures, troubleshooting steps, and final adjustments and include annotated test results to support final project reporting.	2#	CO5
UNIT VI: Report Writing	28	Document project goals, methodology, findings, analysis, and conclusions in a structured report format which includes following. • Title Page which includes: Project Title, Purpose of submission, Institute logo, Students Name, Guide Name, Program, and Institute Name • Certificates: Student declaration, Certificate from guide • Acknowledgement • Table of contents • List of Tables • List of Figures • List of abbreviations and acronyms (if any) • Text 1. Introduction, objectives 2. Literature Survey 3. Methodology/Materials/Methods/Estimate. 4. Results 5.Summary/ Conclusion. 6.References	2#	CO6

	29	Submit the project report to the project guide and revise the report based on feedback. Perform plagiarism check from any free internet site and submit report of plagiarism check to the guide.	2#	CO6
	30	Submit prited copies of project repiort to the guide as per policy of program.	2#	CO6

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Selection of topic, project proposal, planning, and organizing	10
2	Compilation of Literature Review and Methodology	5
3	Execution of project work and testing	25
4	Report writing and viva voce	10
	TOTAL	50

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	-	-	-	3	3	-	-
CO2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	-	-
CO4	2	2	2	2	2	3	3	-	-
CO5	2	2	2	2	2	3	3	-	-
CO6	-	-	-	-	2	3	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Practical Management of Civil Engineering Projects	Er. S.C.Basu Roy Nabhi Publications; 2009th edition (1 January 2009).	978-8172746803
2	Civil Engineering Project Management 4Th Edition	Alan C Twort and J. Gordan Rees CRC Press	

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2. https://www.enggroom.com/Civil/Construction-project.php#google_vignette
3. https://www.iprojectdownload.com/publications/civil-engineering-project-topics/
4. https://iproject.com.ng/civil-engineering/project-topics.html

XVI List of Major Equipment/Machineries with Specification:

1. Equipment as per project requirement.

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. D. K. Parbat	HOD, Civil Engineering	Government Polytechnic, Nagpur
2	Dr. G. V. Gotmare	I/C, Curriculum Development Cell	Government Polytechnic, Nagpur
3	Dr. B. R. Ambade	Lecturer in Civil Engineering	Government Polytechnic, Nagpur
4	Er. G. B. Takey	EE, Vigilance & Quality Control	PWD, Nagpur
5	Dr. Abhay Shende	Principal	J. L. Priyadarshini College of Engineering, Nagpur
6	Dr. V. G. Kondekar	HOD, Civil Engineering	Government Polytechnic, Sakoli

(Dr. D. K. Parbat)
HOD & Chairman PBOS, CE

(Dr. G. V. Gotmare)
Member Secretary PBOS, CE

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Government of Maharashtra
GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/CM/IT/AE/MT/PK/TX/MK/AI
Course Category	:	INP
Course Code	:	IN352H
Course Title	:	Internship (Report Writing)

I Rationale:

The internship course is a critical component of the diploma program, providing students with hands-on experience in a real-world industry setting. The internship takes place after the fourth semester during summer vacation and involves working in a small, medium, or large-scale industry related to the student's field of study. The course is designed to bridge the gap between academic learning and industrial application, allowing students to apply theoretical knowledge in a practical environment. For ease, assessment this course is devided into two semester, semimar assessment in fifth semester and report writing in sixth semester.

The report writing component of the internship course is designed to enhance students' technical writing skills. This part of the course requires students to document their internship experience in a comprehensive report, demonstrating their ability to organize and present technical information clearly and accurately. The report serves as a formal record of the student's industrial experience and is an essential skill for any engineering professional.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Bridge theoretical knowledge with practical experience in a professional environment.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Evaluate** the organization's structure, processes, safety protocols, and industry standards to determine operational effectiveness.

CO2: **Apply** industry-specific tools, technologies, and skills to perform various operations.

CO3: **Contribute** to organizational goals by handling projects/ tasks under mentor guidance, applying learned skills.

CO4: **Analyze** technical challenges, addressing industry-specific issues effectively.

CO5: **Prepare** a internship report, ensuring accuracy and clarity.

CO6: **Submit** internship report in prescribed format.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	10	12	6

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	-	-	25	10	50	20

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)	Topics and Sub-topics	Aligned Cos

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Learn the organization's structure, operational workflow, safety standards, industry practices, methodologies, technologies, and workplace processes to analyze operational efficiency and compliance requirements.	30#	CO1
II	2	Undergo training on industry-specific tools, technologies, and software, while gaining hands-on experience in performing basic operations, troubleshooting, and maintenance tasks, applying relevant skills to real-world industry scenarios and challenges.	60#	CO2
III	3	Participate in daily operations under mentor guidance, handling assigned projects or tasks aligned with industry needs, applying learned skills to contribute to organizational goals and gaining practical experience in real-world scenarios.	150#	CO3

IV	4	Identify and analyze technical challenges in industry, and address industry-specific issues (if any).	60#	CO4
V	5	Prepare a comprehensive internship report that effectively documents work experiences, technical tasks, and key achievements throughout the internship. Ensure the accuracy of the content by cross-referencing with project details. Organize the report clearly, following industry standards.	20#	CO5
VI	6	Submit the internship report following the prescribed format, ensuring all required sections are included, such as introduction, methodology, project details, analysis, conclusions, and recommendations, while adhering to formatting and submission guidelines.	10#	CO6

Note: # Compulsory. Unit No. I to IV during summer vacation in industry and Unit No. V and VI during Sixth Sem.

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. During the summer vacations, after the 4th Semester, students are required to undergo internship with industry/ NGO"s/ Government organizations/ Micro/ Small/ Medium enterprises to make ready for the industry.

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Accuracy, relevance of content	10
2	Organization and Structure	5
3	Technical Writing	5
4	Presentation and Formatting	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Selection of industry	5
2	Work done and Feasibility of work	25
3	Daily diary and supervisor remark	10
4	Problem identification	10
	TOTAL	50

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	-	-	-	-	3	3	-	-
CO2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	3	3	3	-	-
CO5	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	3	-	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Industrial Training and Education	Lokesh Choudhary, Mittal Publications, 2007	10: 8183242367 13: 9788183242363
2	Training Practice	Penny Hackett, McGraw-Hill Education, September 2003	10: 0852929803 13: 9780852929803
3	AICTE Internship Policy: Guidelines & Procedures	All India council of Technical Education New Delhi	-

XV e-References:

1. https://internship.aicte-india.org/ assessed on 23rd April 2024
2. https://www.coursera.org/articles/computer-science-internships assessed on 23rd April 2024

XVI List of Major Equipment/Machineries with Specification:

1. Desktop computers
2. Laser Printer
3. DLP

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. P. Mogre	Principal	Government Polytechnic, Nagpur
2	Dr. M. V. Sarode	HoD, Computer Engineering and I/C Trainining & Placement Officer	Government Polytechnic, Nagpur
3	Dr. G. V. Gotmare	I/C Curricullum Development Cell	Government Polytechnic, Nagpur

(Dr. M. V. Sarode)
HOD & Chairman PBOS, CM

(Dr. G. V. Gotmare)
Member Sectretary PBOS, CM

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COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/PK/MT/IT/AE/CM/TR/TX/MK/AI
Course Category	:	VEC
Course Code	:	VE352H
Course Title	:	Indian Knowledge System

I Rationale:

This course on "Indian Knowledge System" for diploma students is designed as per the requirements of the National Education Policy (NEP) 2020. It aims to provide a comprehensive understanding of India's rich heritage in knowledge, covering areas like philosophy, mathematics, science, engineering, town planning, and Vastu-sastra. By exploring these diverse fields, students will gain insights into the holistic and unique approaches that shaped Indian civilization. The course bridges ancient wisdom with modern technological practices, fostering an appreciation for India's significant contributions to global knowledge.

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Exhibit a comprehensive grasp of Indian knowledge systems, applying their principles across various domains of technology and philosophy.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Exhibit** comprehension of Indian knowledge systems' significance, evolution, and unique holistic approaches.

CO2: **Explore** philosophical principles of Vedic and Non-Vedic schools, emphasizing their significance and unique approaches.

CO3: **Analyze** the Indian numeral system, measurement units, and Bhaskaracarya's contributions to the decimal system.

CO4: **Apply** ancient Indian mathematical methods and principles, emphasizing contributions and practical problem-solving techniques.

CO5: **Analyze** India's science, engineering, and metalworking heritage, emphasizing technological advancements and artistic craftsmanship.

CO6: **Analyze** ancient town planning and architecture while exploring the key principles of Vastu-sastra.

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
-	-	2	-	2	1

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	25	10	25	10	-	-

VI Classroom Learning Content:

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)		Hours	Aligned COs
I	1	Organize a report showcasing ancient Indian knowledge's significance in mathematics, astronomy, medicine, architecture, and global influence.	2#	CO1
I	2	Categorize education features and institutes during Vedic, medieval, and colonial periods, emphasizing methodologies, curricula, and societal impact.	2#	CO1
I	3	Compile a report on Indian knowledge's uniqueness, including holistic approaches, sustainability, ethics, and integration of science and spirituality.	2#	CO1
II	4	Analyze the salient features of philosophical systems belonging to the Vedic school, emphasizing their principles and contributions.	2#	CO2
II	5	Examine the salient features of philosophical systems belonging to the Non-Vedic school, highlighting their distinctive approaches and significance.	2#	CO2
III	6	Investigate the Indian Numeral System and traditional units of measurement, emphasizing their historical development and applications.	2#	CO3

III	7	Explore Bhaskaracarya's Lilavati, focusing on the decimal system and the concept of place value.	2#	CO3
III	8	Compile a report on ancient Indian mathematicians and their significant contributions to mathematics and related fields.	2	CO3
IV	9	Apply Aryabhata's method to find the square root of numbers and verify the results.	2#	CO4
IV	10	Use the Bhakshali method to calculate square roots and verify accuracy through practical examples.	2#	CO4
IV	11	Construct a five-letter binary word table using Pingala's Prastara and explain its systematic arrangement.	2	CO4
V	12	Investigate the science, engineering, and technology heritage of ancient and medieval India, highlighting key achievements.	2#	CO5
V	13	Examine ancient practices in metalworking, metal arts, and idol making, focusing on techniques and innovations.	2#	CO5
VI	14	Analyze the historical development of town planning and architecture in ancient India, highlighting key principles.	2#	CO6
VI	15	Explore the basic limbs of Vastu-sastra, focusing on its foundational concepts and applications.	2#	CO6

Note: # Compulsory

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

IX Specification Table for Classroom Learning Assessment:

X Question Paper Format for Summative Assessment (SA):

XI Scheme of Laboratory Formative Assessment (FA):

S.N.	Criteria	Max. Marks
1	Performance	10
2	Report Writing	10
3	Viva Voce	5
	TOTAL	25

XII Scheme of Self-Learning Summative Assessment (SA):

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	3	-	-
CO6	3	-	-	-	-	-	3	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Introduction to Indian Knowledge System	Dr. Rohidas Nitonde, Notion Press, 2024	!3: 979-889544408-5
2	Introduction to Indian Knowledge System Concept and Applications	B. Mahadevan, Vinayak Rajat Bhat, Narendra Pavana R.N., PHI Learning Private Limited, Delhi, 20124	13: 978-93-91818-20-3

XV e-References:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed78/preview accessed on 15th December, 2024
2. https://www.bing.com/videos/search?q=NPTEL+swayam+indian+knowledge+system&qpvt=nptel+swayam+indian+knowledge+system&FORM=VDRE
3. https://www.bing.com/videos/riverview/relatedvideo?q=NPTEL+swayam+indian+knowledge+system&qpvt=NPTEL+swayam+indian+knowledge+system&vie

XVI List of Major Equipment/Machineries with Specification:

1. Computer System Latest Version

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. R.P. Mogre	Principal	Government Polytechnic, Nagpur
2	Dr. Prasad Gokhale	Professor	Kavikulaguru Kalidas Sanskrit University, Ramtek
3	Dr. P. P. Virkhare	HOD, Travel and Tourism	Government Polytechnic, Nagpur
4	Dr. G. V. Gotmare	I/C, Curriculum Development Cell	Government Polytechnic, Nagpur

(Dr. G. V. Gotmare)
HOD & Chairman PBOS, COMMON

(Dr. G. V. Gotmare)
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GOVERNMENT POLYTECHNIC, NAGPUR
(An Autonomous Institute of Govt. of Maharashtra)
Near Mangalwari Bazar, Sadar, Nagpur-440001

COURSE CURRICULUM

Program	:	Diploma in CE/ME/EE/EC/IT/MT/TX/AE/PK/CM/MK/AI
Course Category	:	INP
Course Code	:	IN353H
Course Title	:	Entrepreneurship and Startup

I Rationale:

Engineering curriculum is a dynamic process. It continuosly evolves itself reflecting the needs and aspiration of learners. In recent times, our society is influenced by knowledge creation and techological advancements. Competencies affecting Innovation and creativity have become important in all walks of life, including business context. This makes entrepreneurship education even more important for enhancing quality of life. Entrepreneurship plays an influential role in the economic growth and development of the country. As the world economy is changing so is the dynamism of the business world. The aim of this course is to inculcate the spirit of Entrepreneurship among the students. The idea of this course is to create "Job providers rather than job seekers."

II Industry Identified Competency:

The Student will be able to do in Industry at entry level:

Inculcate entrepreneur inclination among students.

III Course Outcomes (COs):

After completing this course students will be able to:

CO1: **Develop** entrepreneur mindset among engineering students.

CO2: **Develop** entrepreneural traits for self employment and startup.

CO3: **Establish** problem solving technique to the challenges.

CO4: **Inculcate** characteristic for inovation and developing research mindset.

CO5: **Identify** the need of break even analysis for startups.

CO6: **Explore** business law and trade rules for startup units

IV Learning Scheme:

Classroom Learning (CL)	Tutorial Learning (TL)	Laboratory Learning (LL)	Self-Study Learning (SL)	Notional Learning Hours (NLH)	Credits
1	-	-	1	2	1

V Assessment Scheme:

Classroom Learning				Tutorial/Laboratory Learning				Self-Study Learning	
FA	SA	Total		FA		SA		SA	
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min
-	-	-	-	-	-	-	-	100	40

VI Classroom Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Cognitive Domain)		Topics and Sub-topics		Aligned Cos
UNIT I: Introduction	1a	Develop Entrepreneur mindset among students.	1.1	Concept of entrepreneurship - definition of entrepreneurship by many researcher	CO1
	1b	Examine the process of entrepreneurship	1.2	Function of entrepreneur, Entrepreneurship as a carreer, Need of entrepreneurship in economic, Current scenerio of entrepreneur activity in India.	
UNIT II: An Entrepreneur Journey	2a	Identify the types of entrepreneurs	2.1	Entrepreneur- Types of entrepreneur, Motivation to become an entrepreneur, competencies of an entrepreneur	CO2
	2b	Develop given entrepreneurship traits.	2.2	Entrepreneural skills- Innovative idea generation	
UNIT III: Innovative Entrepreneurship	3a	Establish problem solving technique to given challanges.	3.1	Role of entrepreneurs - problem solvers, Innovations and startups, improve GDP of nation, Working with NGO	CO3

UNIT IV: Marketing	4a	Inculcate given innovation and market research among students.	4.1	Concept of market - elements of market enviornment, micro & macro level of marketing for innovative product	CO4
	4b	Identify given micro and macro market enviornment.	4.2	Conncept of marketing mix and its advantages of innovative product.	
UNIT V: Business Finance	5a	Suggest the sources of finance for given starup.	5.1	Sources of Finance - Advanatage and disadvantages, costing of the product	CO5
	5b	Identify the need of break even analysis for startup and innovative product	5.2	Costing - types of costing, cost of componant and operational cost. Break even analysis of product develop in startup	
UNIT VI: Resources of startup & Managemet	6a	Formulate a comprehensive business setup plan by integrating infrastructure, manpower, machinery placement, and trial production processes.	6.1	Sources to set up business startup- land, power and infrastucture. Organising business setup from placement of manpower, placement of machineries and trial production for the new startup product.	CO6
	6b	Explore basic business law and trade rule for given startup.	6.2	Laws related to business and starup- Trade rule & policy of Government of India	
	6c	Prepare detailed project report	6.3	Various government schemes implemented by MSME, KVIC, DIC, and DST. Write-up for detailed project report for PMEGP, CMEGP.	

VII Laboratory Learning Content:

Unit No	Specific Learning Outcomes (SLO) (In Psychomotor Domain)	Hours	Aligned COs

VIII Self-Study Learning (SLO in Cognitive/Psychomotor/Affective Domain)

1. Prepare a deailed project report (DPR) for any one project on any business/ start-up as you desire. Perform following activities: Market reasearch of the product, Identify demand and supply for the product, Identify area to launch the product, prepare the chart for financing the project, Interact with the bankers for financing the project, Visit to MIDC for land allocation, Prepare the Diagonstic Study Report (DSR), Interact with local government agencies like MSEDCL, Udhyog Registration, and NOC from Polution Board (if required), Collect DPR format from local DIC Centre and submit the complete report for evaluation.

IX Specification Table for Classroom Learning Assessment:

Unit No.	Units	Classroom Learning Hours	C/O	Levels from Cognition Process Dimension			Total Marks
				R	U	A	
1	Entrepreneurship Concept & Importance	3	C	0	0	0	0
			O	0	0	0	0
2	An Entrepreneur journey	2	C	0	0	0	0
			O	0	0	0	0
3	Entrepreneurship as innovation and startup	3	C	0	0	0	0
			O	0	0	0	0
4	Marketing of Innovative & startup product	2	C	0	0	0	0
			O	0	0	0	0
5	Business finance for startup	2	C	0	0	0	0
			O	0	0	0	0
6	Resources of startup & Managemet	3	C	0	0	0	0
			O	0	0	0	0
Total		15	C	0	0	0	0
			O	0	0	0	0

*C - Compusory O - Optional
*R – Remember U – Understand A – Analyze / Apply

X Question Paper Format for Summative Assessment (SA):

-----NA-----

XI Scheme of Laboratory Formative Assessment (FA):

XII Scheme of Self-Learning Summative Assessment (SA):

S.N.	Criteria	Max. Marks
1	Collection of data	20
2	Visit to Market Research	20
3	Survey report	10
4	Report writing/Viva-Voce	50
	TOTAL	100

XIII COs-POs/PSOs Mapping Matrix:

Course Outcomes	Program Outcomes							Program Specific	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	3	3	-	-	-
CO2	3	-	-	-	3	3	-	-	-
CO3	3	-	-	-	3	3	-	-	-
CO4	3	-	-	-	3	3	-	-	-
CO5	3	-	-	-	3	3	-	-	-
CO6	3	-	-	-	3	3	1	-	-

XIV Textbooks, BIS Codes References:

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	An Investigation of Entrepreneurial Inclination Among Engineering Students	C. P. Kapse, M. K. Das, Serial Publication, New Delhi	13: 978-8193342046
2	Entrepreneurship	Rajiv Roy, Oxford University Press, 2011	13: 978-0198072638
3	Entrepreneurship Development	Ulhas Chandra Das, Centre for Distance & Online Education Utkal University, Bhubaneswar.	-
4	Financial Management	I. M. Pandey, Vikas Publishing House Pvt. Ltd., 2004	10: 81-259-0638-X
5	Principles and Practice of Management	R. S. Gupta, B. D. Sharma, N. S. Bhalla, Kalyani Publishers, 2011	13: 978-81-272-7076-6

XV e-References:

1. https://ediindia.org/research-publication/faculty-publications/ assessed on 21st December 2024

XVI List of Major Equipment/Machineries with Specification:

1. NIL

XVII List of Industry Experts and Faculties who contributed for this curriculum:

S.N.	Name	Designation	Institute / Industry
1	Dr. C. P. Kapse	I/C HOD, Textile Manufacture	Government Polytechnic, Nagpur
2	Dr. S. G. Gaikwad	Selection Grade Lecturer, Textile Manufacture	Government Polytechnic, Nagpur
3	Prof L.S.Chakraborty	Lecturer, Textile Manufacture	Government Polytechnic, Nagpur
4	Prof Harshal Ramteke	HOD Textile Technology	SASMIRA, Mumbai
5	Mr Laxminarayan Kaushik	Director	LLP Professional, Nagpur
6	Dr Ganesh Kakad	HOD Textile Engineering	JDIT, Yavatmal
7	Prof S. S. Lawand	Selection Grade Lecturer, Textile Manufacture	Government Polytechnic, Nagpur

(Dr C. P. Kapse)
HOD & Chairman PBOS, TX

(Dr. G. V. Gotmare)
Member Sectretary PBOS, TX

Appendix II

Guidelines

Guidelines

for

Integrated Personality Development Courses (VE151H & VE152H)

1. For registration, use IPDC Campus course registration platform.
2. Use following links for registrations: (Use ipdc-campus-course-portal-user-manual for reference)
   i) IPDC Coordinators and Faculty Members Login Portal
   https://campus.ipdc.org/portal/Home/LoginForUsers/
   ii) IPDC Coordinator registration:
   https://campus.ipdc.org/portal/Home/coordinatorRegistration/
   iii) IPDC Faculty Members Registration
   https://campus.ipdc.org/portal/Home/facultyRegistration/
   iv) IPDC Students Registration
   https://campus.ipdc.org/portal/Home/studentRegistration/

3. IPDC Campus Course desktop application will be used to deliver lecture content to IPDC students into the physical classroom. Lecture content will have introductory films, lecture videos, student interactions, and workbook activities.
4. Role of IPDC Coordinators:
   i) Register yourself as an IPDC Coordinator, ask IPDC Administrator for approval.
   ii) Make sure that faculty members under your institution must register themselves.
   iii) Approve faculty members registered under you, by login portal via your profile.
5. Role of IPDC Faculty Members:
   i) Register yourself as an IPDC Faculty Member, ask your IPDC Coordinator for approval.
   ii) Make sure that your respective students must register themselves.
   iii) Enter the particular semester duration (only once) and approve students registered under you, by login portal via your profile.
   iv) Download desktop application from login portal via your profile login and install it to the computer system from which you want to conduct the multimedia lectures.
   v) Login to the desktop application by your profile, download the lectures and start conducting IPDC lectures.
6. Lectures will take place in the department classrooms and will be hosted by an integrated personality development course (IPDC) trained Faculty.
7. The Teaching resources will be provided by Swaminarayan Aksharpith on IPDC portal.
8. Each lecture has four components as shown below:
   i) **Introductory Film:** Each lecture begins with a short film that introduces the topic through modern production. The original content displays relatable scenarios and visuals that captivate the students' attention and stimulates their curiosity to learn more.

ii) **Lecture Video:** Students watch a lecture video presented by a dynamic speaker. The lecture reinforces the significance and necessity of fundamental principles and skills. The experience of the speaker, eloquence of presentation, and use of interactive visuals collectively create a profound impact on each student's mind and heart.

iii) **Student Interaction:** Student interaction sessions promote stimulating discussion and conversation and help create safe spaces for the healthy exchange of ideas. Thus, each session provides a forum in which students can openly express their emotions and thoughts.

iv) **Workbook Activities:** Workbooks assist students to begin implementing the values taught in the lecture into their personal lives. Reliable research, priceless experience, practical scenarios, and reflective questions are innovatively depicted, motivating students to contemplate and think creatively.

9. The assessments should include continuous assessment of 25 marks as mentioned in curriculum and based on the internal examination based on the question-bank with answers from each subject of IPDC provided by IPDC team.

Guidelines

for

Basic Internship Course (IN251H)

Duration of Summer Internship after Second Semester: **1st June to 30th June.**

Duration of Internship in Second Semester for DSY Student: **Part-time within Sem.**

Introduction:

The Basic Internship course provides diploma students in engineering with a four-week summer vacation internship opportunity after the second semester. The internship encompasses various inter/intra-institutional activities aimed at skill development, innovation, and professional growth. Students engage in practical experiences within institutional settings and are evaluated based on their daily activities documented in a diary.

As mentioned in program structure of third semester of NEP aligned 2023 Curriculum "Basic Internship" full time four week (120 Notional Hours) is mandatory for first year admitted students in the year 2023 and part-time (120 Notional Hours) during third semester for direct second year admitted students.

Internship activities:

During Internship students are required to be involved in:

1. Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; (In case of Government Polytechnic, Nagpur by Continuing Education Department (CED).
2. Contribution at incubation/ innovation /entrepreneurship cell of the institute.
3. Participation conferences/ workshops/ competitions etc.
4. Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop.
5. Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.
6. In case student want to pursue their family business, and don't want to undergo internship, a declaration by a parent may be submitted directly to the Head of the Department.

Documentation:

1. The Head of the Department should prepare a list of students indicating their consent for participation in the internship, along with the details of the internship location.
2. Every student is required to prepare a daily diary containing documentary proofs of the activities done by him during internship.

3. The report writing, preparation of presentation and the evaluation of these activities will be done by faculty mentor during third semester.
4. Students should use daily diary prepared by curriculum development cell.

Guidelines

for

Internship Course (IN351H and IN352H)

Duration of summer Internship after Fourth Semester: **1st June to 15th August.**

Introduction:
As mentioned in program structure of fourth and sixth semester of NEP aligned 2023 Curriculum a full time twelve week (360 Notional Hours) is mandatory for the students.
The internship course is a critical component of the diploma program, providing students with hands-on experience in a real-world industry setting. The internship takes place after the fourth semester during summer vacation and involves working in a small, medium, or large-scale industry related to the student's field of study. The course is designed to bridge the gap between academic learning and industrial application, allowing students to apply theoretical knowledge in a practical environment.
For ease, assessment of this course is divided into two semesters, seminar assessment in fifth semester (IN351H- Internship (Seminar)) and report writing (IN352H- Internship (Report Writing)) in sixth semester.

Internship activities:
During the summer vacations, after the 4th Semester, students are required to undergo internship with industry/ NGO"s/ Government organizations/ Micro/ Small/ Medium enterprises to make ready for the industry.

Documentation:
1. The Head of the Department should issue the letter to the industry in prescribed format framed by TPO.
2. The Head of the Department should prepare a list of students indicating their consent for participation in the internship, along with the details of the internship location.
3. Every student is required to prepare a daily diary containing documentary proofs of the activities done by him during internship.
4. The report writing, preparation of presentation and the evaluation of these activities will be done by faculty mentor during fifth and sixth semester as mentioned in curriculum.
5. Students should use daily diary prepared by curriculum development cell.

Guidelines

for

Generic Elective Courses

Introduction:

As third semester curriculum and program structure of NEP aligned 2023 curriculum were approved in 46th Board of studies meeting held on 20th June 2024. However, it is suggested by Hon. Chairman of BOS that the allotment of generic electives course should be as per "Inter-Se-Merit" of students rather than "first cum first serve" basis.

Decision as per Institute Level Committee Meeting held on 1st July, 2024.

i) Awareness workshop will be arranged by HOD of program related to Generic Elective Courses in offline or online mode for the students of III semester before registration.

ii) Sealing of Generic Elective seats is as per intake capacity of program plus 20% (for EWS/TFWS/DSY students).

iii) Quota of Generic Elective courses will be allotted by ILC. Refer annexure-I for program-wise quota for Generic Elective Course.

iv) Allot Generic Elective Course as per departmental "Inter-Se-Merit" by taking preferences for all Twelve programs other than own program. (For Computer Engineering, Information Technology and AIML for remaining Ten Programs)

v) Final registration of Generic Elective course of all students will be done by registration in-charge after allotting the GE course as per above procedure.

Timetable slots of Generic Elective Courses.

All program should keep reserved following slots for Generic Elective Course.

Day	Time	Remarks
Thursday	3.45 to 5.45 PM (last two periods)	Practical for first Batch
Friday	10.00 to 11.00 AM (First Period)	Theory Period- 1
Friday	3.45 to 5.45 PM (last two periods)	Practical for Second Batch
Saturday (working)	10.00 to 12.00 Noon (Second Period)	Theory Period- 2
Saturday (working)	1.00 PM to 5 PM	Practical for Third Batch

Use "Zero Period" between 9.00 AM to 10 AM for timetable to adjust department timetable, if required.

Annexure-I

Abstract of Generic Elective Quota

S.N.	Name of Program	Quota/Seats													
		CE	ME	EE	EC	IT	MT	TX	AE	PK	CO	MK	AIML	TX	Total
1	Civil Engineering	00	30	15	38	15	10	8	15	8	15	8	8	8	178
2	Mechanical Engineering	30	00	12	30	12	8	6	12	6	12	6	6	6	146
3	Electrical Engineering	15	12	-	15	6	4	3	6	3	6	3	3	3	79
4	Electronics & Telecommunication Engineering	38	30	15	-	15	10	8	15	8	15	8	8	8	178
5	Information Technology	15	12	6	15	-	4	3	6	3	-	3	-	3	70
6	Metallurgical Engineering	8	6	3	8	3	-	2	3	2	3	2	2	2	44
7	Textile Manufacture	8	6	3	8	3	1	-	3	1	3	1	1	1	39
8	Automobile Engineering	15	12	6	15	6	4	3	-	3	6	3	3	3	79
9	Packaging Technology	8	6	3	8	3	1	1	3	-	3	1	1	1	39
10	Computer Engineering	15	12	6	15	-	4	3	6	3	-	3	-	3	70
11	Mechatronics	8	6	3	8	3	1	1	3	1	3	-	1	1	39
12	Artificial Intelligence and Machine Learning	8	6	3	8	-	2	2	3	2	-	2	-	2	38
		168	138	75	168	66	49	40	75	40	66	40	33	41	

List of Generic Elective Courses (Multidisciplinary) for Civil Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Mechanical Engineering	120	30	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
2	Electrical Engineering	60	15	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
3	Electronics & Telecommunication Engineering	150	38	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
4	Information Technology	60	15	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
5	Metallurgical Engineering	36	10	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	8	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	15	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	8	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	15	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	8	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	8	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	8	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**178**			

List of Generic Elective Courses (Multidisciplinary) for Mechanical Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	30	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Electrical Engineering	60	12	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
3	Electronics & Telecommunication Engineering	150	30	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
4	Information Technology	60	12	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
5	Metallurgical Engineering	36	8	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	6	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	12	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	6	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	12	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	6	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	6	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	6	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**146**			

List of Generic Elective Courses (Multidisciplinary) for Electrical Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	15	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	12	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electronics & Telecommunication Engineering	150	15	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
4	Information Technology	60	6	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
5	Metallurgical Engineering	36	4	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	3	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	6	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	3	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	6	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	3	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	3	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	3	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**79**			

List of Generic Elective Courses (Multidisciplinary) for Electronics & Telecommunication Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	38	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	30	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	15	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Information Technology	60	15	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
5	Metallurgical Engineering	36	10	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	8	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	15	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	8	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	15	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	8	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	8	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	8	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**178**			

List of Generic Elective Courses (Multidisciplinary) for Information Technology Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	15	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	12	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	6	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	15	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Metallurgical Engineering	36	4	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	3	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	6	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	3	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Mechatronics	30	3	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
10	Travel and Tourism	30	3	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**70**			

List of Generic Elective Courses (Multidisciplinary) for Computer Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	15	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	12	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	6	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	15	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Metallurgical Engineering	36	4	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	3	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	6	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	3	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Mechatronics	30	3	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
10	Travel and Tourism	30	3	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**70**			

List of Generic Elective Courses (Multidisciplinary) for AIML Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	8	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	6	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	3	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	8	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Metallurgical Engineering	36	2	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
6	Textile Manufacture	30	2	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	3	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	2	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Mechatronics	30	2	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
10	Travel and Tourism	30	2	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**38**			

List of Generic Elective Courses (Multidisciplinary) for Automobile Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	15	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	12	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	6	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	15	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Information Technology	60	6	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
6	Metallurgical Engineering	36	4	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
7	Textile Manufacture	30	3	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
8	Packaging Technology	30	3	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	6	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	3	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	3	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	3	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**79**			

List of Generic Elective Courses (Multidisciplinary) for Metallurgical Engineering Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	8	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	6	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	3	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	8	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Information Technology	60	3	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
6	Textile Manufacture	30	2	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
7	Automobile Engineering	60	3	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	2	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	3	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	2	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	2	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	2	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**44**			

List of Generic Elective Courses (Multidisciplinary) for Textile Manufacture Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	8	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	6	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	3	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	8	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Information Technology	60	3	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
6	Metallurgical Engineering	36	1	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
7	Automobile Engineering	60	3	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Packaging Technology	30	1	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
9	Computer Engineering	60	3	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	1	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	1	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	1	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**39**			

List of Generic Elective Courses (Multidisciplinary) for Packaging Technology Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	8	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	6	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	3	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	8	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Information Technology	60	3	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
6	Metallurgical Engineering	36	1	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
7	Automobile Engineering	60	3	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Textile Manufacture	30	1	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
9	Computer Engineering	60	3	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Mechatronics	30	1	MK291H: Basic Mechatronics	MK292H: Computer Aided Design	MK391H: Automotive Mechatronics
11	Artificial Intelligence and Machine Learning	30	1	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	1	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**39**			

List of Generic Elective Courses (Multidisciplinary) for Mechatronics Program Students and Quota for Registration

SN	Name of Program	Intake	Quota/Seats	Third Semester	Fourth Semester	Fifth Semester
1	Civil Engineering	150	8	CE291H: Civil Engineering Practice	CE292H: Basic Surveying	CE391H: Building Services
2	Mechanical Engineering	120	6	ME291H: Elements of Mechanical Engineering	ME292H: Workshop Technology	ME391H: Heat Engine Technology
3	Electrical Engineering	60	3	EE291H: Electrical Generation, Transmission and Distribution	EE292H: Electrical Machines	EE391H: Electrical Wiring and Estimation
4	Electronics & Telecommunication Engineering	150	8	EC291H: Analog and Digital Electronics	EC292H: Principles of Communication Engineering	EC391H: Microcontroller and Applications
5	Information Technology	60	3	IT291H: Applied Multimedia Techniques	IT292H: Web Designing	IT391H: Cyber Security and Privacy
6	Metallurgical Engineering	36	1	MT291H: Foundry Technology	MT292H: Testing of Materials	MT391H: Heat Treatment
7	Automobile Engineering	60	3	AE291H: Basics of Automobile	AE292H: Two-Wheeler Technology	AE391H: Four-Wheeler Technology
8	Textile Manufacture	30	1	TX291H: General Textile Technology	TX292H: Dyeing and Printing	TX391H: Garment and fashion Technology
9	Computer Engineering	60	3	CM291H: Open-Source Technologies	CM292H: Web Development	CM391H: Digital Marketing
10	Packaging Technology	30	1	PK291H: Basics of Packaging Technology	PK292H: Folding Carton & Corrugated Box Manufacturing	PK391H: Injection & Extrusion Blow Molding in Packaging
11	Artificial Intelligence and Machine Learning	30	1	AI291H: Python Programming	AI292H: Basics of Artificial Intelligence	AI391H: Machine Learning
12	Travel and Tourism	30	1	TR291H- Agro & Rural Tourism	TR292H- Wildlife Tourist Guide/ Naturalist	TR391H- Tourism Resources of India
		Total	**39**			