

OUTCOME BASED CURRICULUM 2016

Program Diploma in Mechanical Engineering



**Government Polytechnic,
Nagpur**

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

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The mission of Government Polytechnic, Nagpur is-

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- M2** : To inculcate values and ethics for life-long learning through curricular, co-curricular and extra-curricular activities
- M3** : To develop facilities and services for academic excellence
- M4** : To enhance the skills of faculties and staff through industry institute collaboration

OUTCOME BASED CURRICULUM 2016



Program: Diploma in Mechanical
Engineering



by

Curriculum Development Cell,

Government Polytechnic, Nagpur

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CHAPTER 1

Government Polytechnic, Nagpur an Introduction

This chapter gives the history of Government Polytechnic, Nagpur.

1.1 History

The **Government Polytechnic, Nagpur** is an oldest technical institution in central India. It was founded on 14th July 1914 as the Government Engineering School. At its commencement the school had 16 students on roll and was located in the Victoria Science College (now the Institute of Science) in Nagpur. During its first year the school provided courses in Civil Engineering & Mechanical Engineering up to diploma standard. Later in 1915 Automobile Engineering Course was also established which was subsequently converted into Post Diploma in Automobile Engineering. The institution has given birth to Engineering College presently known as Visvesvaraya National Institute of Technology, Nagpur (VNIT). The school was expanding rapidly & from 16 students enrolled in 1914 increased to nearly 2000 in current year and Govt. Engineering School converted to Government Polytechnic, Nagpur.

1.2 Autonomy

The Institute has recently celebrated its Centenary year. Government Polytechnic, Nagpur has history of 102 Glorious Years. The Government Polytechnic, Nagpur is committed to contribute to through excellence in technical education, to serve as valuable resource for industry and society. The institute is always upright in responding to educational needs of its changing world's scenario.

From academic session 1995 the institute was conferred with autonomous status by Government of Maharashtra as per Government Resolution No. WBP-1093/(2640) (69)VE-5 Dated- 31st March, 1994, in context of academic matter viz. identification of

need of new programs, requisite curriculum design, implementation of self-designed curriculum, assessment, evaluation and certification of students.

1.3 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”

1.4 Geographical Location of Nagpur City

The latitude of Nagpur, India is 21.146633, and the longitude is 79.088860. Nagpur, India is located at India country in the Cities place category with the gps coordinates of 21° 8' 47.8788" N and 79° 5' 19.8960" E. Nagpur, India elevation is 311 meters height. Nagpur is located at the exact centre of the Indian peninsula. Figure 1.1 shows the location. The city has the Zero Mile Stone locating the geographical centre of India, which was used by the British to measure all distances within the Indian subcontinent. [Wikipedia]. The city gets its name from the river Nag, which flows through the city, originating at a small village called Lavha. It is famous for the Nagpur orange and is known as the "Orange City" for being a major trade centre of oranges cultivated in the region.



Figure 1.1. Location of Nagpur City

1.5 Government Polytechnic, Nagpur 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. The campus map of GPN is shown in Fig. 1.2.



Figure 1.2. Government Polytechnic, Nagpur Campus

CHAPTER 2

Polytechnic Education System

This chapter describes the polytechnic education system in India. Various bodies responsible for polytechnic education in India are also described below.

2.1 Higher Education System in India

The aim of any country's higher education system is sustainable development and achieving higher growth rates. It is enabled through creation, transmission and dissemination of knowledge. To achieve this, India has setup a school education system and higher education system. The higher education system is one of the strongest parts of the Indian education system.

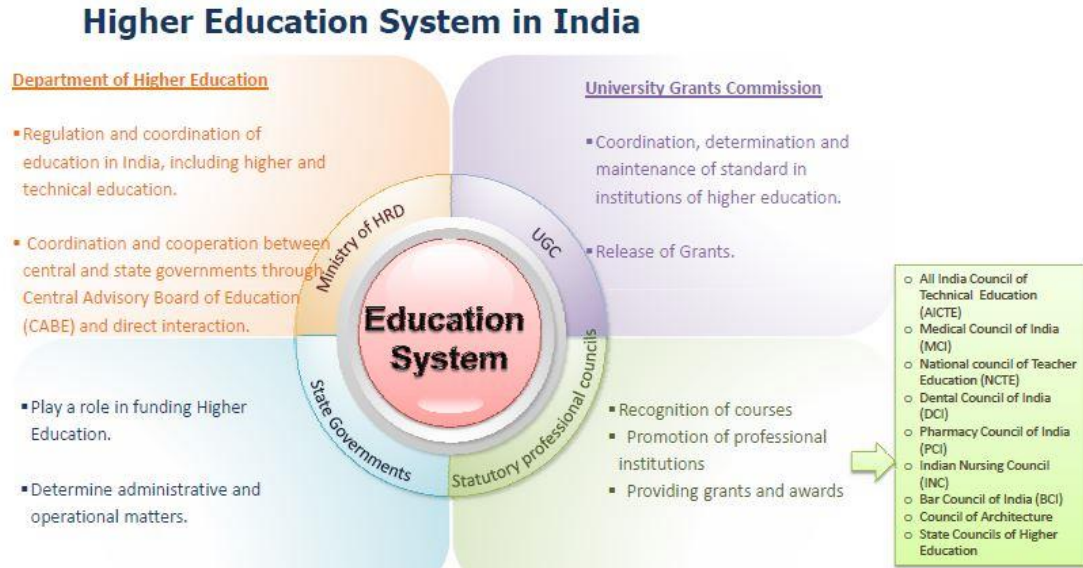


Figure 2.1. Higher Education System in India

Figure 2.1 shows the various bodies responsible for higher education in India, with their roles; as follows:

1. Ministry of Human Resource Development (HRD)

- Regulating and coordination of education in India
 - Coordination and cooperation between central government through central advisory board of education (CABE) and direct interaction
2. University Grant Commission
 - Coordination, determination and maintenance of standards in institutes of higher education
 - Release of grants
 3. State Governments
 - Funding Higher Education
 - Determine administrative and operational matters
 4. Statutory Professional Councils their roles and responsibilities.
 - Recognition of Courses
 - Promotion of Professional institutions
 - Providing grants and awards

The higher education in India is categorised in to following three categories as shown in fig 2.2:

1. General Education
2. Professional Education
3. Vocational Education

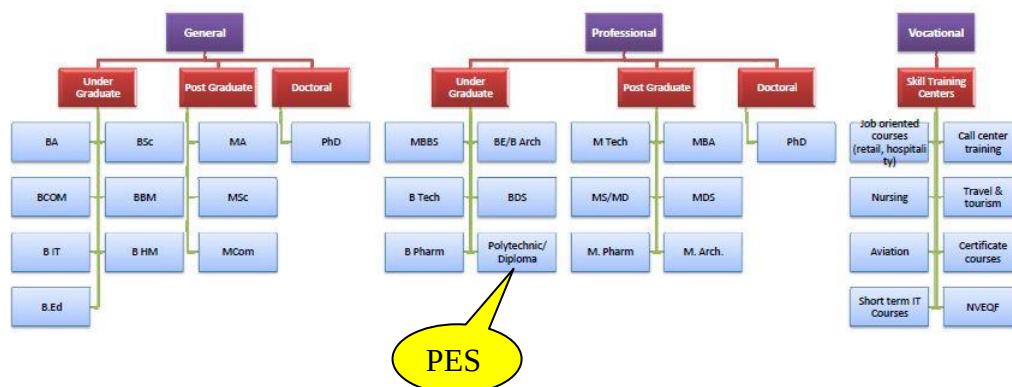


Figure 2.2. Classification of Higher Education System in India

Polytechnic Education System (PES) in India is the undergraduate level category of professional Education.

GPN is one of the autonomous polytechnic of PES in India. It is mandatory for GPN to follow the guidelines framed by the various bodies responsible for technical education, which are as follows:

2.1.1 Department of Higher Education, MHRD

The Department of Higher Education, MHRD, is responsible for the overall development of the basic infrastructure of Higher Education sector, both in terms of policy and planning in India. Under a planned development process, the Department looks after expansion of access and qualitative improvement in the Higher Education, through world class Universities, Colleges and other Institutions

2.1.2 All India Council for Technical Education (AICTE)

The All India Council for Technical Education (AICTE) has been in existence since November 1945 as a national level Apex Advisory Body. AICTE became a statutory body through an act of Parliament 52, in 1987.

AICTE was established with a view to the proper planning and co-ordinated development of the technical education system throughout the country, the promotion of qualitative improvement of such education in relation to planned quantitative growth and the regulation and proper maintenance of norms and standards in the technical education system for matters connected therewith. One of the major functions of AICTE is to lay down norms and standards for courses, curricula, physical and instructional facilities, staff pattern, staff qualifications, quality instructions, assessment and examinations.

2.1.3 National Board of Accreditation (NBA)

The National Board of Accreditation (NBA), India was initially established by AICTE (All India Council of Technical Education) under section 10(u) of AICTE act, in the year 1994, for periodic evaluations of technical institutions & programmes basis according to specified norms and standards as recommended by AICTE council.

NBA in its present form came into existence as an autonomous body with effect from 7th January 2010, with the objective of Assurance of Quality and Relevance of Education, especially of the programmes in professional and technical disciplines, i.e., Engineering and Technology, Management, Architecture, Pharmacy and Hospitality, through the mechanism of accreditation of programs offered by technical institutions.

NBA has introduced a new process, parameters and criteria for accreditation. These are in line with the best international practices and oriented to assess the outcomes of the programme. NBA adopted Outcome Based Education (OBE) model for accreditation of all engineering programs in India from 2013.

2.1.4 Higher and Technical Education, Government of Maharashtra

It is the apex authority responsible for steering and supporting the development and growth of quality Higher and Technical Education that meets educational and social objectives of the state. This department is highly committed towards inclusive education and realizes the importance of quality of education and has undertaken numerous initiatives for achieving highest quality standards in the field of education. Accreditation and Re-accreditation of the Universities and Institutes of higher learning has been made mandatory to ensure the quality of institutions.

2.1.5 Directorate of Technical Education (DTE), Government of Maharashtra

The role of the Directorate is to maintain, enhance the standard, quality of technical education by laying the policies, establishing developing Govt. Institutions, guiding supervising the aided, private institutions, interacting with industry and national level institutions, co-ordinating with other departments of State Government, Government of India Statutory Organisations and to contribute to the development of industry society at large.

2.1.6 Maharashtra State Board of Technical Education (MSBTE)

Maharashtra State Board for Technical Education (MSBTE) was established with the enactment of the Maharashtra State Board of Technical Education Act 1997 to regulate the matters pertaining to diploma level technical education in the state of Maharashtra. According to act section 34, the autonomous institutions shall be required to obtain equivalence for their courses and programmes from the MSBTE. The MSBTE shall monitor all academic and examination related activities of the Autonomous Institutions such as curriculum, teaching examination scheme, teaching hours, academic schedule, eligibility of candidate to appear for the examination, etc.

2.2 Polytechnic Education System

Polytechnic education in India constitutes an important segment of Technical Education and contributes significantly to the economic development. Aimed at creating a vast amount of technical manpower, the polytechnics have played a vital role in providing skilled manpower at various levels for organized, unorganized and Service Sectors.

The aim of the polytechnic education is to create a pool of skill based manpower to support shop floor and field operations as a middle level link between technicians and engineers. The pass-outs of Diploma level Institutions in Engineering & Technology play an important role in managing shop-floor operations. It is further an established fact that small & medium Industry prefer to employ Diploma Holders because of their special skills in interpreting engineering, drawings, estimating, costing, billing, supervision, measurement, testing, repair & maintenance etc.

Curriculum is an educational programme designed, developed & implemented in formal educational system to achieve pre-determined & pre-stated educational objectives. Every individual social system comes in to existence as a result of need of its output emerged in its environment. Educational objectives of PES can be stated as follows:-

- a) To cater to specific manpower need in overall Technical Manpower Spectrum of industry and society that lies between craftsman on one side and technocrat on other.

- b) To cater the man power need of primary, secondary and tertiary sector of industry.
- c) To cater to individual educational need for development of self, community and society.
- d) To cater to an individual need to update him in tune with advancement in engineering and technology.

Educational objectives stated above talk about manpower with-certain task profile. To develop such task profile in an individual, which consists in general of all duties and associated tasks and sub tasks that an individual is supposed to perform, it is required to organize various experiences in different setups viz. classrooms, laboratories, workshops and fields, through out any educational programme. With such experiences it should be ensured that students acquire requisite knowledge, skills, attitudes and abilities to perform sub tasks and duties and finally job which he is likely to get after passing programme.

Hence, it is essential to design education program taking in to account predetermined objectives in the form of curriculum, then develop requisite resources viz. physical like space, equipment, and furniture etc. human, information and implement it to achieve the educational objectives.

CHAPTER 3

Curriculum Development System

This chapter describes the organization structure, curriculum development system and the various bodies responsible for the development of curriculum of GPN.

3.1 Organizational Structure of GPN

GPN, being part of PES it has been catering needs of individual, community, society and industry since last 102 years. Up to 1995 services being offered by GPN were under different status viz. university, MP DTE and MSBTE.

In 1995 the institute was conferred with autonomous status by Government of Maharashtra as per Government Resolution No. WBP-1093/(2640) (69)VE-5 Dated- 31st March, 1994, in context of academic matter viz. identification of need of new programs, requisite curriculum design, implementation of self-designed curriculum, assessment, evaluation and certification of students. In nutshell accountability regarding academic matters referred above followed by placement of students in world of work is trusted on the institute. Functional organization of students in world of work is entrusted to the institute. Functional organization parallel to hierarchical organization of institute is constituted for running institute under autonomous status effectively and efficiently. Fig. 3.1 shows the organizational structure of GPN.

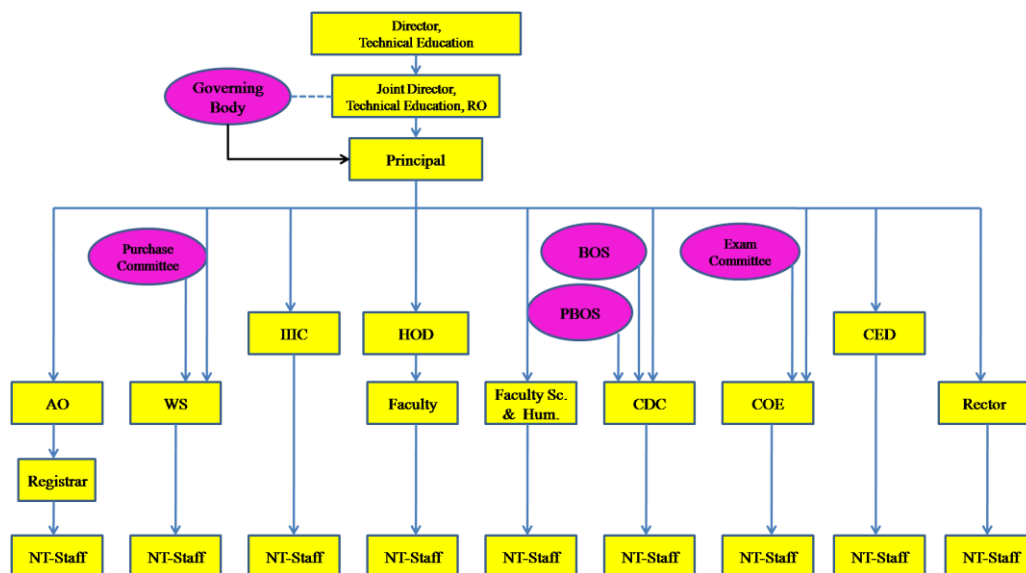


Figure 3.1. Organizational Structure of GPN

3.2 Curriculum Development System

Since, 1995 the institute has been designing/revising and implementing curricula of 11 programmes. This is being done using Curriculum Development System shown in Figure 3.2.

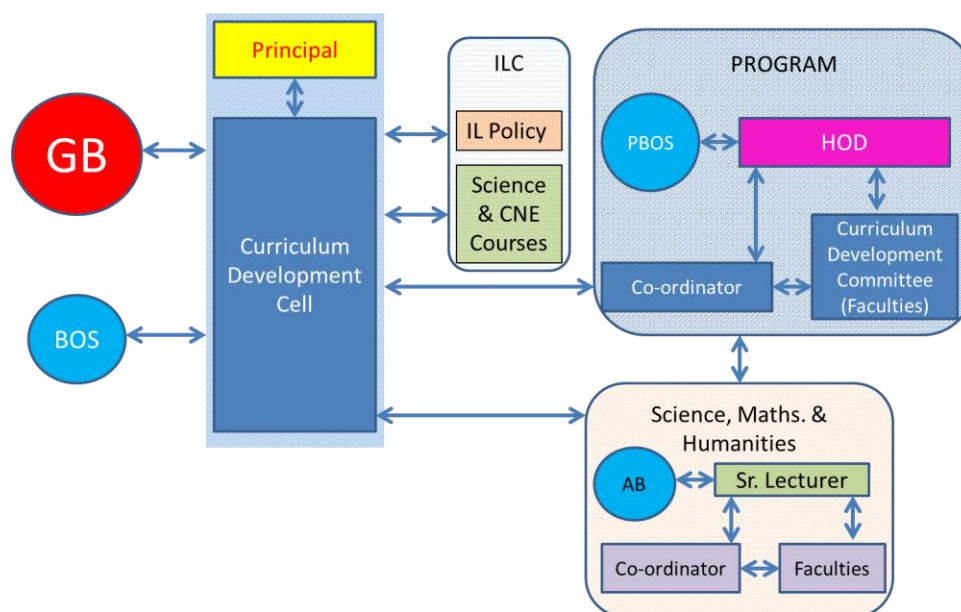


Figure 3.2. Curriculum Development System

Curriculum Development System consists of Programs (Civil, Mechanical, and Electrical etc.), Non Programme Department (Science, Maths, and Humanities), Institute Level Committee (ILC), and Curriculum Developmental Cell (CDC) headed by Principal of the Institute. Institute follows certain process in designing, revising, developing and implementing curriculum and student assessment & evaluation for enhanced students' learning. The constitutional bodies Governing Body (GB), Board of Studies (BOS) and Program wise Board of Studies (PBOS) for programs and non-constitutional body i.e. Advisory Board (AB) for Non Programme Department are responsible for approval of curriculum.

3.2.1 Governing Board (GB)

GB is an apex body. The committee members and roles and responsibilities of GB of GPN are stated below:

- **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.

3.2.2 Board of Studies (BOS)

BOS is an Institute level committee. The committee members and roles and responsibilities of BOS of GPN are stated 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.

3.2.3 Program Wise Board of Studies (PBOS)

PBOS is a program level committee. GPN is having 11 PBOS committees. The committee members and roles and responsibilities of PBOS of program of GPN are stated 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 coursewise.
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.

3.2.4 Advisory Board (AB)

Non Program Department (Science, Maths, and Humanities) are not having PBOS as per the Government Resolution. The AB is constituted in line with the PBOS for Non Program Department. There are 4 AB each for Physics, Chemistry, Mathematics and English Department.

CHAPTER 4

Outcome Based Education Philosophy

Government Polytechnic, Nagpur adopted the OBE approach for curriculum design because, National Board of Accreditation (NBA) focusing on the adoption of OBE approach for all engineering programmes in India from 2013 for accreditation. Programmes to be accredited from 2013 will have to be based on OBE approach. NBA adopted Outcome based Model because, OBE is “Learner Centric” rather than “Teacher Centric”

4.1 Outcome Based Education

Outcome Based Education (OBE) is an education approach that focuses on the graduate attributes or outcomes after completing an academic programme. Outcome based approach means knowing what you want to achieve and then taking the steps to do so.

Some Benefits of OBE are-

1. More directed and coherent curriculum.
2. Graduates (students) will be more “relevant” to industry and other stakeholders.

The framework required for implementation of OBE consists of the following as shown in Figure 4.1 and consists of:

- Outcome Based Curriculum (OBC): What students should able to do?
- Outcome Based Teaching learning (OBTL): Making the students to achieve the outcomes
- Outcome Based Assessment (OBA): How to measure, what the students has achieved?

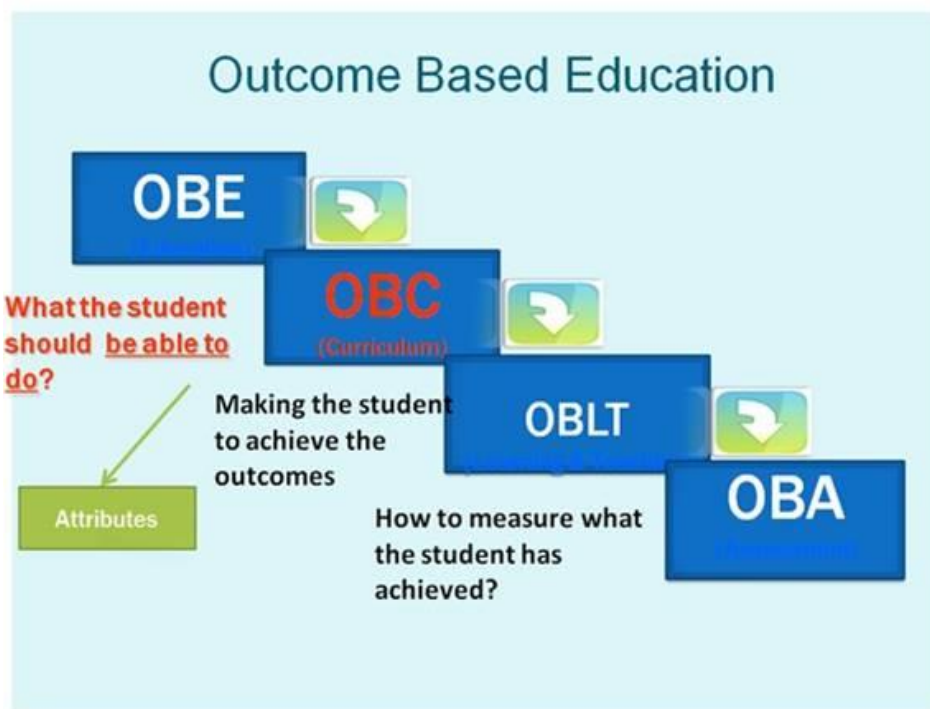


Figure 4.1. Outcome Based Education Framework

4.2 KEY constituents of OBE

Figure 4.2 shows the key constituent of OBE.

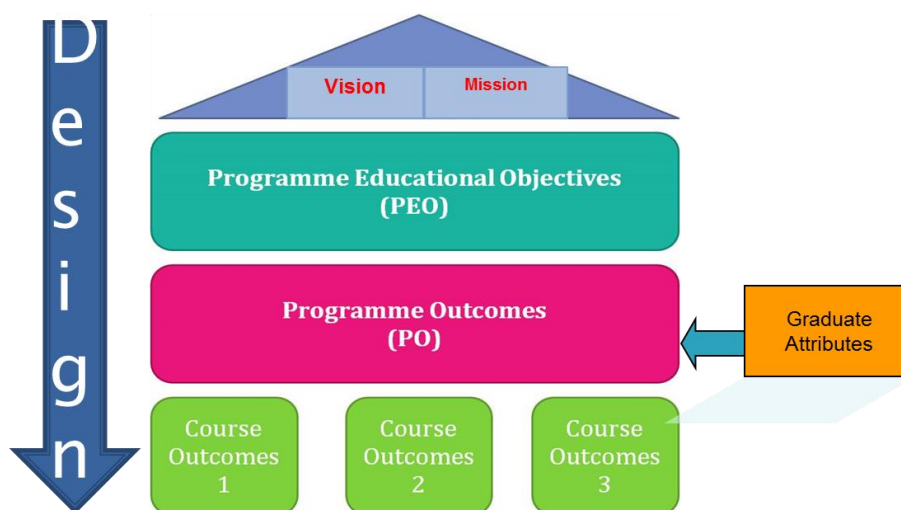


Figure 4.2. Key Constituents of OBE

4.2.1 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.

4.2.2 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.

4.2.3 Graduate Attributes (GA's)

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.

4.2.4 Program Outcomes (PO's)

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) of NBA. 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.

Following are POs (Ten) for all diploma engineering programs as per NBA guidelines-

1. **Basic Knowledge:** Ability to apply knowledge of basic Mathematics, Science and Engineering to solve the engineering problems
2. **Discipline Knowledge:** Ability to discipline specific knowledge to solve core and/or applied engineering problems
3. **Experiments and Practice:** Ability to plan and perform experiments and practices and use the results to solve engineering problems

4. **Engineering tools:** Apply appropriate technologies and tools with an understandings of limitations
5. **The Engineer and Society:** Demonstrate knowledge to assess the societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to engineering practice.
6. **Environment and Sustainability:** Understand the impact of engineering solutions in societal and environmental context, and demonstrate knowledge and need for sustainable development.
7. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
8. **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse/ multidisciplinary teams.
9. **Communication:** An ability to communicate effectively.
10. **Life-long learning:** Recognize the need for, and have preparation and the ability to engage in independent and life-long learning in context of technological changes.

4.2.5 Program Educational Objectives (PEO's)

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.

4.2.6 Program Specific Outcomes (PSO's)

No definition for PSO's is found in literature. According to Dr. B.L. Gupta, NITTTR, Bhopal, PSO's are the broad statements of Program specific outcomes as per the local needs.

4.2.7 Course Outcomes (CO's)

Course Outcomes (COs) are clear statements of what a student should be able to demonstrate upon completion of a course. They should be assessable and measurable knowledge, skills, abilities or attitudes that students attain by the end of the course. It

is generally a good idea to identify between four and seven. All courses in a particular programme would have their own course outcomes. These course outcomes are designed based on the requirement of the programme outcomes (POs). Each course outcomes are mapped to a relevant PO and they are mapped to the programme educational objectives (PEO). The teaching learning process and assessment methods are to be designed in such a way to achieve the COs. It is important to ensure that the student is able to acquire the knowledge or skill required. Table 4.1 clarifies the difference between Course Objectives Vs Course Outcomes

Table 4.1. Difference between Course Outcomes and Course Objectives.

Course Objectives	Course Outcomes
Describe what a teacher needs to teach, and what needs to be planned to teach.	Describe what students should demonstrate upon the completion of a course.
Example- At the end of the course, students will- Understand the types of wiring system.	Example- At the end of the course, students will be able to- Choose a suitable wiring system for particular installation.

4.2.8 Specific Learning Outcomes (SLO's) or Learning Outcomes (LO's)

Learning outcomes (LO's) or Specific Learning Outcomes (SLO's) are “*statements of what is expected that the student will be able to do as a result of learning the activity*”. (Jenkins and Unwin, 2001); i.e at the end of each unit or chapter. SLO's should also be assessable and measurable knowledge, skills, abilities or attitudes that students attain by the end of the unit

CHAPTER 5

Bloom's Taxonomy

Outcome-based education is an educational model in which curriculum and pedagogy and assessment are all focused on student learning. Learning is a relatively permanent change in behaviour potentiality that results from reinforced practice or experience. A group of educational psychologists led by Benjamin Bloom develops a taxonomy, or classification system, for learning. Some aspects of Bloom's Taxonomy is described below.

5.1 Introduction to Bloom's Taxonomy

Benjamin Bloom (1948) developed classifications of intellectual behaviour and learning in order to identify and measure progressively sophisticated learning. Bloom's taxonomy is especially important in higher education where outcomes need to address the student ability to use information, not just recall and regurgitate concepts. Lower levels of learning are easier to assess but do not adequately display what the student can do with the knowledge. However, learning is not a purely cognitive function; learning occurs differently when it entails performing a skill or re-evaluating behavior. This approach is based on biological structure of human being as shown in figure 5.1.

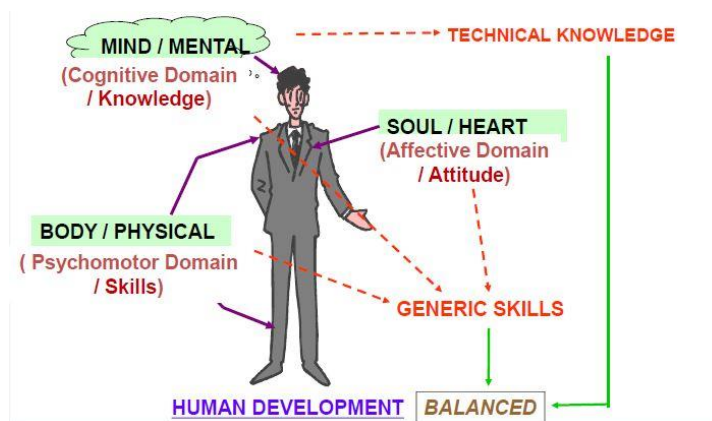


Figure 5.1. Human Being and Domains of Learning

Important elements of this approach which form basics of learning are explained below.

5.2 Domains of Learning

Learning is a process by which students develop relatively permanent change in mental associations through experience. This is how learning is defined by cognitive psychologists. Behavioral; psychologists define learning as a relatively permanent change in behavior. However, learning is not a purely cognitive function; learning occurs differently when it entails performing a skill or re-evaluating behavior.

There are following domains of learning:

- A: Cognitive Domain relates to intellectual skills or abilities
- B: Affective Domain relates to emotions, feelings, likes, dislikes etc.
- C: Psychomotor Domain relates to manipulative skills of hands, legs. Eye-hand coordination

In Engineering & Technology courses, endeavor is made to design curriculum with a focus on development of cognitive skills through classroom teaching, whereas manipulative (psychomotor) skills are developed in workshops, laboratories & seminars where students work individually or in a group. Development of affective skills attitudes and value is supposed to be acquired through projects and co-curricular activities. These are also developed from the work culture or institutions.

How far a student has developed these abilities/skills especially from cognitive and psychomotor domains is assessed on the basis of suitable examinations. When classroom and laboratory teaching is viewed in this light, evaluation becomes an integral part of teaching – learning process.

5.2.1 Cognitive Domain

Dr. Benjamin Bloom (1956) analysed questions asked in various examinations in American situation and proposed a hierarchical arrangement of instructional objectives (Intellectual abilities) tested by these questions.

The lowest level of cognitive learning achieved by a student is demonstrated by the recall of information that the student retrieves from his long term memory. So, the storage and retrieval of specific facts, concepts, principles, laws, definitions, properties, procedures etc. directly from memory was classified as a knowledge level objective. Thus questions

testing memory of students were treated as at the lowest level of the hierarchy of intellectual abilities. The other levels of hierarchy proposed by Dr. Bloom in 1956 relate to the degree of information processing required in the brain needed to provide answer to a question. The various levels in the cognitive hierarchy proposed by Dr. Bloom in 1956 and further revised in 2001 are shown in figure 5.2.

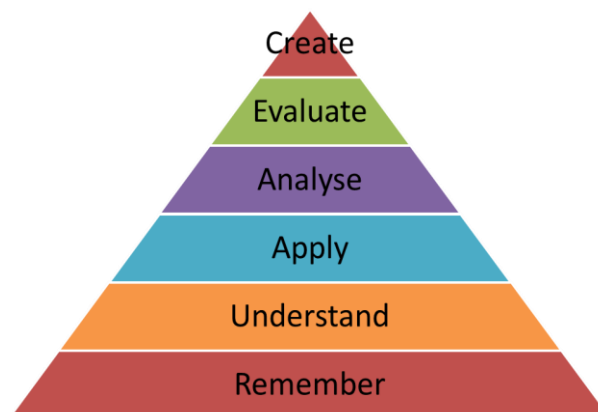


Figure 5.2. Revised cognitive hierarchy Levels

Table 5.1. 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

5.2.2 Psychomotor Domain

The Psychomotor Domain (RH Dave's version, 1970) was established to address skills development relating to the physical dimensions of accomplishing a task. Because, 'motor' skills extend beyond the originally traditionally imagined manual and physical skills, always consider using this domain, even if you think your environment is covered adequately by the Cognitive and Affective Domains. Whatever the situation, it is likely that the Psychomotor Domain is significant.

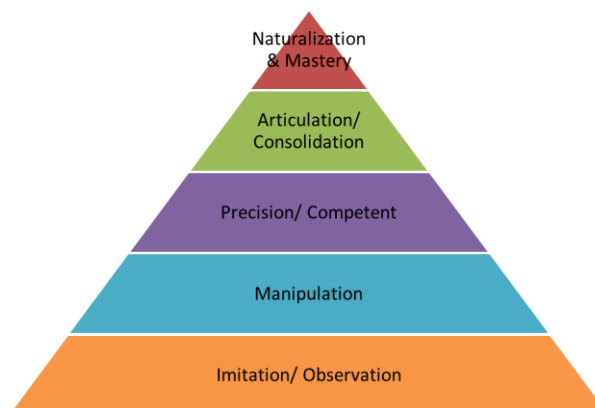


Figure 5.3. Psychomotor hierarchy Levels

Table 5.2. 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

5.2.3 Affective Domain

Affective Domain, was detailed by Bloom, Krathwhol and Masia (1964, *Taxonomy of Educational Objectives: Vol. II, The Affective Domain*.) Bloom's theory advocates this structure and sequence for developing attitude - also now commonly expressed in the modern field of personal development as 'beliefs'. As with the other domains, the Affective Domain detail provides a framework for teaching, training, assessing and evaluating the effectiveness of training and lesson design and delivery, and also the retention by and affect upon the learner or trainee.

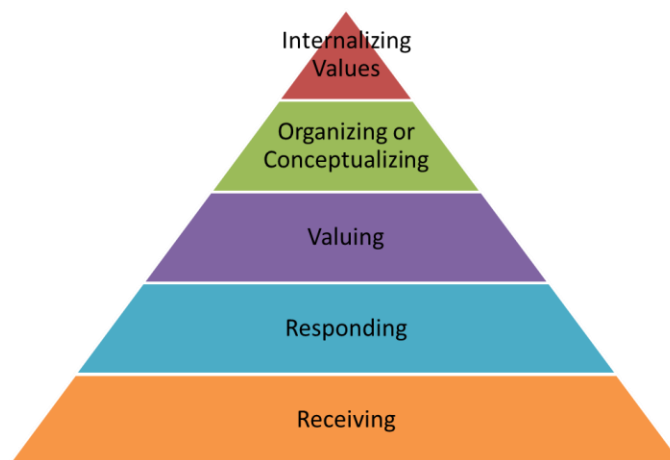


Figure 5.4. Affective Domain hierarchy Levels

Table 5.3. 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,

5.3 Program Outcomes and Domains of Learning

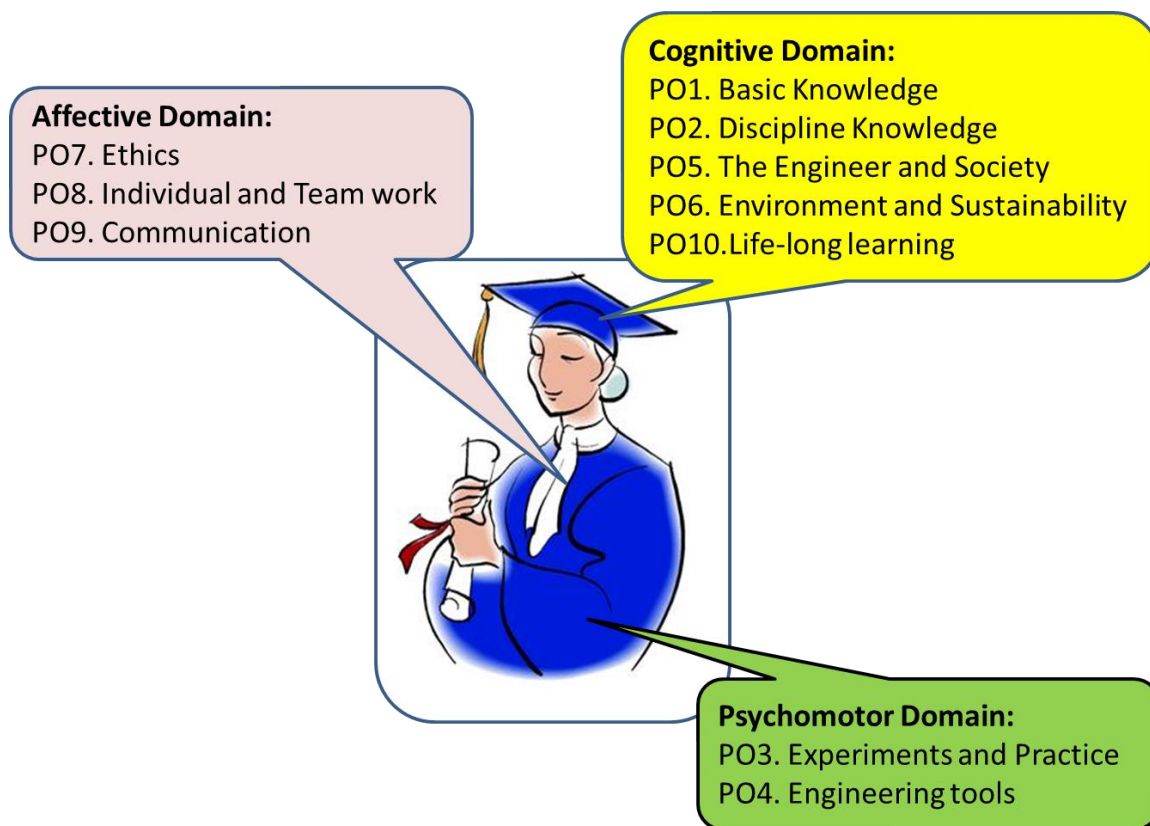


Figure 5.5. Program Outcomes and Domains of Learning

Program Outcomes (POs) framed by NBA for diploma students are the specific characteristics required by the stake holders in the students. There is definite relation between these outcomes with the three different domain of learning, which are described in figure 5.5. These classification plays major role while framing curriculum.

CHAPTER 6

Curriculum Revision Process

Since, autonomous status GPN revised curriculum after every 5 years. 2016 revision is the fifth revision. Concept of Bloom's Taxonomy is included in GPN curriculum since the beginning; however the complete model of OBE is adopted first time in the curriculum revision process. The complete curriculum revision process is described below.

6.1 Change Management

GPN is the diploma level educational institute is having total 12 diploma program, out of which 11 programs are under autonomous status. Curriculum revision of such 11 programs in a short period with the new unknown model is a huge task before CDC. It is natural reaction of human being even in the best circumstances for any change, is to resist.

GPN used ADKAR model for change management. This diagnostic tool helps our organization and our employees understand where they are in the change process. We use this tool to identify gaps in your change management process and to provide effective coaching for our faculties.

The ADKAR model is used to:

- manage faculties resistance
- help faculties transition through the change process
- create a successful action plan for curriculum development
- develop a strategy of curriculum development

6.1.1 ADKAR Model for Change Management

ADKAR has become very popular with managers and project teams because this change management model is easily applied and simple to teach to others, including executive sponsors of change. ADKAR stands for:

- **Awareness** : Awareness of the need for change
- **Desire** : Desire to participate and support the change
- **Knowledge** : Knowledge on how to change
- **Ability** : Ability to implement required skills and behaviors
- **Reinforcement** : Reinforcement to sustain the change

Following change management tools are used in curriculum revision process.

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

Figure 6.1 shows the mapping of these tools with ADKAR.

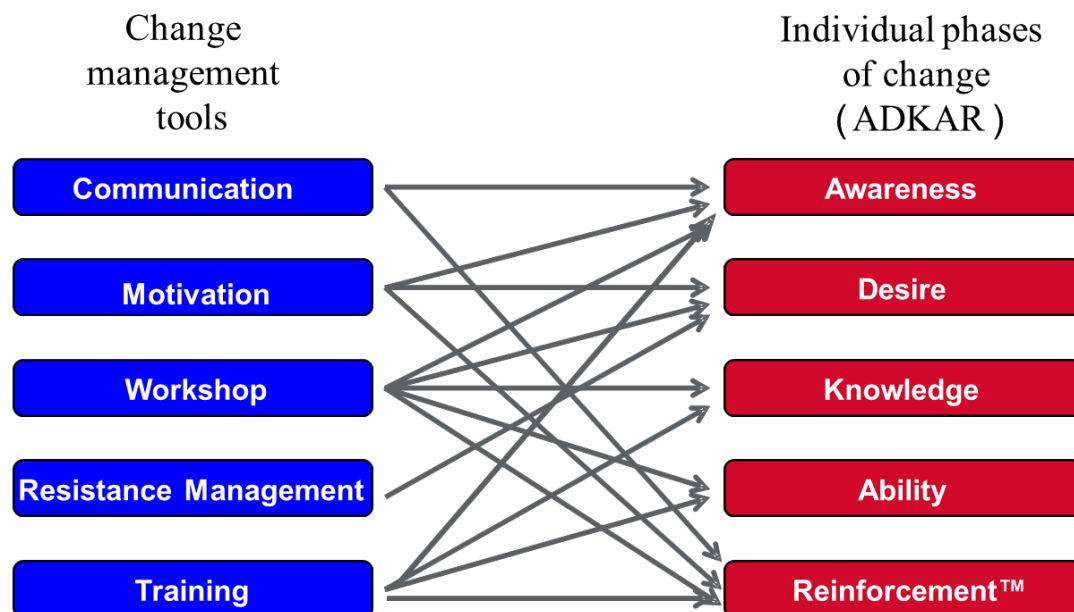


Figure 6.1. Mapping of change management tools with ADKAR

6.1.2 Results of ADKAR Model

As a result of using ADKAR model for change we got following results:

- Date of Starting curriculum Revision process : 23/01/2016
- Date of Completion of curriculum Revision process : 24/11/2016
- Time Period to complete curriculum Revision : 11 Months.
- No. of Programs for curriculum Revision : 11
- No. of Courses for curriculum Revision : 293
- Implementation of OBE curriculum from : July 2016

6.2 Curriculum Revision Process

Following Method is adopted for Development of Curriculum

- Study Outcome Base Education Philosophy
- Analyse OBE Curricula of Diploma in Engineering in India and Autonomous Institute (MS) curricula
- Analyse Model Diploma in Engineering curriculum by AICTE
- Compare 2011 curriculum with MSBTE existing curriculum
- Study NBA/AICTE/MSBTE/NSQF guidelines
- Organize Search Conference for validation of skills
- Collect Feedback (Program-wise) on existing curriculum from stake holders
- Curriculum mapping with POs to identify curriculum gaps
- Decide Institute Level policies
- Develop Model
- Prepare Action Plan for development
- Analyse and Brain storming at program level
- Develop Vision, Mission and PEOs and curriculum at program Level (Framing, Mapping, Editing, Revising)
- Approve from PBOS, BOS and GB.

6.2.1 Study of OBE Philosophy

CDC studies the OBE philosophy, which is described previously in this document. The training of faculties are arranged for awareness of faculties.

6.2.2 Analysis of OBE curricula

Following Boards in India adopted Outcome based curriculum for Diploma in Engineering:

- Gujarat Technological University-2014-15
- Board of Technical Examinations, Bengaluru, Karnataka- 2015-16
- State Board of Technical Education, Kerala state- 2015-16
- MSBTE is going for OBE from- 2017-18

The analysis of above OBE curriculum of each and every program is a huge task; however CDC studied curriculum of Diploma in Electrical Engineering of above said boards and analyze their curriculum based on the following points.

- Credits
- Credits Ratio TH:PR
- Total Courses
- Examination Scheme
- Comparison of Autonomous Curriculum in State

The results are shown in table 6.1 to 6.5

Table 6.1. Credits Comparison

Boards	Theory Periods	Practical Periods	Credits
GTU, Ahmedabad (OBE)	95	87	182
BTE, Bengaluru (OBE)	88	108 (2Pr=1Cr)	142
SBTE, Kerala (OBE)	NA	(2Pr=1Cr)	47 per Year
MSBTE, Mumbai (G scheme)	106	93	199
AICTE Model Curriculum	90	102 (2Pr=1Cr)	145
G. P. Nagpur (2011)	113	87	200

Table 6.2. Credit Ratio TH:PR Comparison

Boards	TH:PR
GTU, Ahmedabad (OBE)	52:48
BTE, Bengaluru (OBE)	62:32
SBTE, Kerala (OBE)	70:30 (I yr)
MSBTE, Mumbai (G scheme)	53:47
AICTE Model Curriculum	64:36
G. P. Nagpur (2011)	57:43

Table 6.3. Courses Comparison

Boards	Theory Courses	Practical Courses
GTU, Ahmedabad (OBE)	28	06
BTE, Bengaluru (OBE)	22	18
SBTE, Kerala (OBE)	NA	NA
MSBTE, Mumbai (G scheme)	31	12
AICTE Model Curriculum	29	16
G. P. Nagpur (2011)	29	12

Table 6.4. Examination Scheme Comparison

Boards	Theory		Practical	
	TEE	CA	TEE	CA
GTU, Ahmadabad (OBE)	70	30	20/40	30/60
BTE, Bengaluru (OBE)	100	25	50	25
SBTE, Kerala (OBE)	100	50	50	50

MSBTE, Mumbai (G scheme)	100	25	50	25/50
AICTE Model Curriculum	70	20*+10**	50	25
G. P. Nagpur (2011)	80	20	25	25/50

*Progressive Test

** Assignments

Table 6.5. Comparison of Autonomous Curricula

Institute	TH	TU	PR	Total	Theory Papers	Practical	Total Courses
G.P. Mumbai	96	12	68	176	25	13	38
VJTI, Mumbai	92	16	86	194	27	19	46
G.P. Aurangabad	103	00	81	184	26	13	39
G.P. Kolhapur	104	00	76	180	31	10	41
G.P. Nasik	111	03	82	196	29	11	40
G.P. Nagpur	113	05	82	200	29	12	41

6.2.3 Comparison with MSBTE Existing Curriculum

As mentioned 2.1.1, autonomous institutions shall be required to obtain equivalence for their courses and programs from the MSBTE, it is essential to compare GPN curriculum with existing curriculum for variation in content, Existing Courses for Revision/Deletion, New Courses proposed, detailed Comparison of Examination Scheme. This task is performed at program level. The analysis of this task is used to decide the course outcomes, course contents as well as to finalize the program structure of revised curriculum. The formats for the same are shown in table 6.6 to 6.9.

Table 6.6. Comparison of Existing Curriculum-2011 with MSBTE-2012 Curriculum

SN	MSBTE Curriculum				Equivalent course in Autonomous Curriculum				Content Variation if any with MSBTE
	Subject Code	Name of Subject	TH Periods	PR Periods	Course Code	Name of course	TH Credits	PR Credits	

Table 6.7. List of Existing Courses for Revision/Deletion etc.

Sr. No.	Course Code	Name of Course	Write-R (Revision) NR (No Revision) D (Deletion)	Reason for R/NR/D	Name of New title if proposed

Table 6.8. List of New Courses proposed

Sr. No.	Name of new courses proposed (if any)	Reason for introduction of New courses

Table 6.9. Comparison of Examination Scheme with MSBTE Curriculum

Sr. No.	Points	MSBTE Curriculum	Autonomous Curriculum	Remarks if any
1	Theory Paper Maximum marks			
2	Practical Maximum marks			
3	Progressive Test Maximum marks			
4	Term work Maximum marks			
5	No. of subject/courses having internal practical exam.			
6	No. of subject/courses having external practical exam			

7	No. of subject/courses having internal oral exam			
8	No. of subject/courses having external oral exam			
9	No. of subject/courses having term work			
10	No. of non-exam subject/courses			
11	Industrial training included in curriculum (Yes/No)			

6.2.4 Study of NBA/AICTE/MSBTE Guidelines

The guidelines given in following documents are studied, and the final conclusions are made to framed curriculum documents.

1. Orientation Workshop on Outcome Based Accreditation NBA training text material- to frame Vision, Mission of the Institute, Vision, Mission, PEOs of the program.
2. AICTE Guidelines- 21st Academic Council Meeting of AICTE on 3rd April, 2013 to decide percentage of various level courses. The abstract of the guidelines is mentioned in the table 6.10.

Table 6.10. Abstract of Guidelines

S. N.	Levels	Percentage	Course Heads
1	General	5 to 10%	Language / Communication skills
			Humanities and Social Science
			Economics & Principle of management
			NSS, NCC, NSO, Rural Development
2	Basic Science	15 to 25%	Computer literacy with numerical analysis
			Mathematics
			Physics
			Chemistry

3	Engineering Sciences and Technical Arts	15 to 25%	Engineering Graphics
			Workshop Practice
			Engineering Mechanics
			Electrical Science I (Basic Electrical Engineering)
			Thermodynamics and Heat Transfer
			Material Science and Engineering
			Electrical Science II (Electronics and Instrumentation)
4	Professional Subjects	55 to 65%	
i)	Professional Core	22.5 to 27.5%	Minimum number of Core courses suggested by experts
ii)	Professional Elective	12.5 to 15%	About 10% Electives should be made available to the students
iii)	Free Elective	7.5 to 10%	Open interdisciplinary electives allow a student to diversify his/her spectrum of knowledge
iv)	Project	5 to 10%	
v)	Seminar & Industrial Training	2.5 to 5%	

3. MSBTE Guidelines MSBTE/D-10/Director/2012/303 Dt.1st October, 2012-

The important guidelines given by MSBE are as follows:

- Credits should not be more than 160 and should be uniform across the program
- Curriculum should be laboratory based and having more practical weight age
- Curriculum should be restricted to five levels
- 4th and 5th level courses are considered for award of diploma
- Practical Examination should be based on performance only.

- Implant training should be made compulsory any time in vacation after first year and separate credits should be given.
- Online examination of courses should be start gradually. To begin with one course per semester.

6.2.5 Search Conference

The search conference is organized at institute level on dated 12/02/2016. The experts from the industries, academic institutions and alumni were present. The main objectives of organization of search conference are as follows:

- Validate generic and technical skills identified by the program.
- Suggest new skills to be developed in a technician pertaining to specific work area by industry/ field experts.
- Collect Feedback on existing curriculum and suggestions on previous received feedback.
- Suggest new course content to be incorporated in curriculum.
- Obtain suggestions on various topics related to program structure.
- Analyze and prepare a final list of generic skills and technical skills and from courses based on validated skills later on.
- Formation of Courses

6.2.6 Curriculum mapping

The 2011 curriculum is mapped to identify Program strengths (attributes that are widely addressed) and Gaps (attributes that are addressed by only a few learning experiences).

The simplest form of curriculum map is a matrix whose rows are the learning experiences (curriculum courses) and columns are the Graduate attributes (or Program Outcomes).

The curriculum courses include General Studies Courses, Basic Science Courses, Engineering Sciences and Technical Arts Courses, Professional Courses (Core, project, seminar etc.), Elective Courses.

To establish the curriculum map, each faculty member reviews his/her courses and identifies the attributes that are addressed in the course based on its content and materials.

A sample curriculum mapping sample is shown in Table 6.10. Program wise curriculum mapping is given in subsequent chapter.

Table 6.11. Curriculum mapping (Sample)

SN	Course code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
			Basic Knowledge	Discipline Knowledge	Experiments and Practice	Engineering tools	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team work	Communication	Life-Long Learning	Maintain Electrical Equipment's	Maintain Electrical Power System
1	EV1101	Environmental science	X	-	-	-	X	X	X	X	X	X	-	-
2	EE1301	Basic Electrical Engineering	X	X	X	X	-	-	X	X	X	X	X	X
3	EE1401	Electrical Circuit and Network	X	X	X	X	-	-	-	X	-	X	X	X
4	EE1402	Electrical Measurement	-	X	X	X	X	-	X	X	-	X	X	X

6.2.7 Institute Level Policies

Institute level policy for curriculum development is decided by the CDC on the basis of followings:

- OBE Model
- Analysis of various curriculum Autonomous Institute/ MSBTE curriculum/ OBE curriculum
- NBA/AICTE/MSBTE Guidelines
- Feed Back from stake holders
- Search Conference Outcomes
- Curriculum Mapping of 2011 curriculum and
- GPN 2011 Curriculum

The following institute level suggestions are forwarded to the various programs for framing program structure.

1. Levels of Courses V

- **Level I- General studies courses- 5 (5 to 10%)**
 1. English
 2. Communication Skill
 3. Environmental science
 4. Economics & Management
 5. Rural development (Non Theory)
- **Level II- Basic Science Courses- 6 (15 to 25%)**
 6. C programming (including introduction to office tools) (Non Theory) (Note: Letter on this course is changed to Computer Applications as suggested in CM/IT PBOS)
 7. Physics
 8. Chemistry
 9. Mathematics-I
 10. Mathematics-II
 11. Mathematics- III

(Note: The program which does not require mathematics-III course, may opt for more Computer literacy with numerical analysis courses. Letter on three mathematics courses are converted into two mathematics courses, by increasing the credits)
- **Level III Engineering Sciences and Technical arts courses- 7 (15 to 25%) (should be programme specific)**
 12. Engineering Graphics (Theory)
 13. Workshop Practice (program specific) (Non Theory)
 14. Electrical Science I (Basic Electrical Engineering)
 15. Electrical Science II (Electronics and Instrumentation)
 16. Material Science and Engineering (program specific)

17. Engineering Mechanics

18. Thermodynamics and Heat Transfer (or mechanical related e.g. Elements of Mechanical Engineering for EE or program specific as per the experts suggestions)

- **Level IV- i) Professional Core Courses– 11- 22.5% to 27.5%**

19. to 27- Theory cum Practical Courses

28 to 29 – Practical courses (Non-Theory)

(Note: Letter on number of core courses are increased to 14)

- ii) **Project Courses- 5 to 10%**

30 to 31 – Practical Courses prerequisite for project (Non-Theory) Department specific workshop + program related design laboratory

32. Industrial Project

- iii) **Seminar and Industrial Training Courses- - 2.5 to 5%**

33. Seminar

34. Industrial Training/Practices

- **Level V- Elective Courses– 11- 22.5% to 27.5%**

- i) **Professional Elective Courses- 5/8 - 12.5 to 15%**

35. to 42- Theory cum Practical Courses

(Note: Letter on number of professional electives are changed to 3/6)

- ii) **Free Elective- 7.5 to 10%**

43. Finishing School (Common for all Branch)

44 to 53. Any one Elective Course each from 10 programs

(Note: Letter on number of electives courses are changed to 1/12)

2. **Detailed Curriculum Response**

CDC has suggested the various responses on various criteria based on the above study and are given in table 6.12

Table 6.12. Suggestive Curriculum at a Glance

SN	CRITERION	Suggestive RESPONSE
1	Total No. of Courses in a Program	55*
2	Total courses required.	41
3	No. of courses having theory papers.	29
4	No. of courses having non Theory exam.	12
5	No. of General Studies courses	5
6	No. of Basic Science Courses	6
7	No. of Engineering Science courses	7
8	No. of Professional Core courses	11
9	No. of Professional Elective courses	5/8
10	No. of Professional Free Elective courses	2/10*
11	No. of Project courses	3
12	No. of Seminar courses	2/3
13	Total credits (1 Th Hr = 1Credit & 2 Pr Hr = 1Credit)	150-155
14	Total marks	4600 (approx.)
15	Proportion of Hours (Periods), Th : Pr	50:50 (approx.)
16	Proportion of credits, Th : Pr	65:35 (approx.)
17	Proportion of marks; Th : Pr	50:50 (approx.)
18	Total courses for Award of Class	12
19	Total theory paper courses for Award of Class	10
20	Total marks for Award of Class	1600

6.2.8 Development of Curriculum Revision Model

Top to bottom design approach model of OBE described in Figure 4.2 is found in literature. No other model is found in literature. OBE is not only top to bottom design approach; it is a 360⁰ approach model. Based on this 360⁰ CDC developed our own model based on the study described above. Government Polytechnic, Nagpur model is named as GoPoNa Model. The model is as shown in figure 6.2.

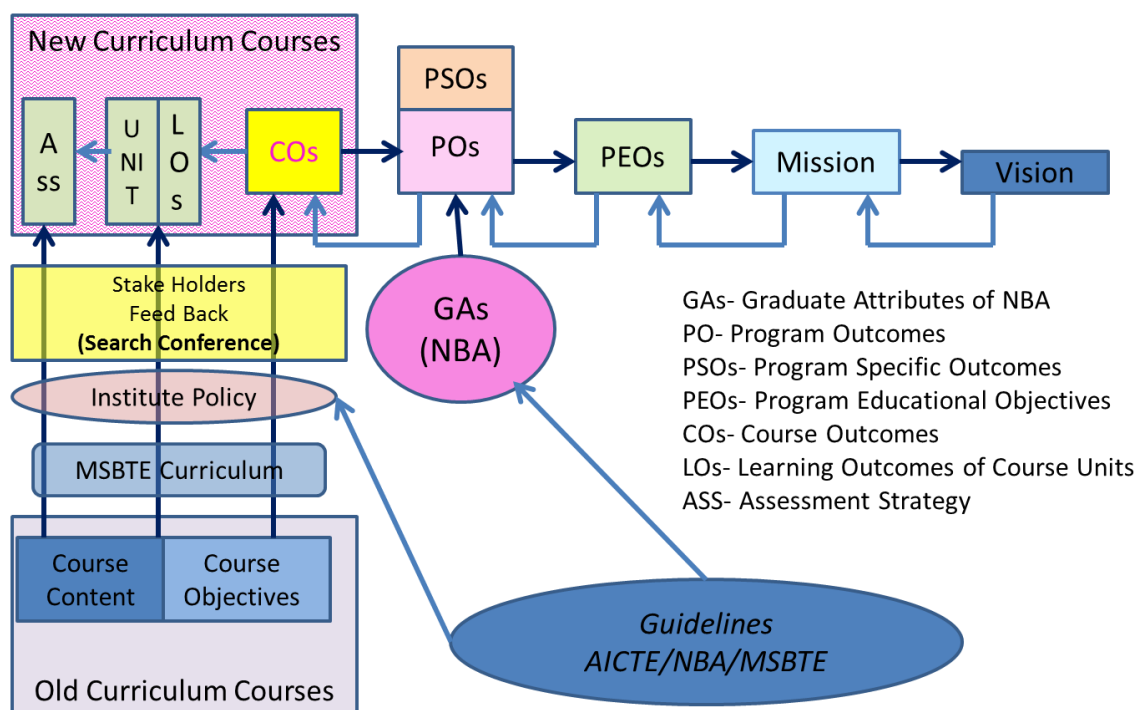


Figure 6.2. GoPoNa Model

GoPoNa Model is based on the OBE philosophy, various guidelines framed by the AICTE/NBA/MSBTE, and Search conference outcomes (feedback from stake holders). As OBE is 360⁰ approach various feedback loops are provided in the model for continuous improvement. The model is self-explanatory.

6.2.9 Preparation of Action Plan

Due to time constraint it is decided that the curriculum development process should be divided in to two phases. In first phase Curriculum of common courses i.e. Level I, II, III

are to be develop. And in second phase program specific courses of level IV and V are to be developed. The action plan is prepared for the both phases and is shown in table 6.13 and table 6.14 respectively.

Table 6.13. First Phase Action Plan

S.N.	Activity	Period/Date of Completion, up to
1	- Formation of PBOS at departmental level - Formation of institute level committee for deciding common policies. - Formation of committee for deciding Basic Engg. , Science and CNE courses policies	31/12/2015
2	Comparison of 2011 curriculum with MSBTE curriculum (Preliminary Task)	02/01/2016
3.	Meeting for deciding common policies of outcome based curriculum at institute level.	19/01/2016
4	Meeting for deciding policies of Basic Engg. , Science and CNE courses.	19/01/2016
5	Workshop for outcome based design procedure	22/01/2016
6	Preparation of Vision, Mission statements, POs and COs at program level	01/02/2016
7	Preparation of program structure based on outcome based education (course titles, scheme etc) by all programs (first draft, based on the information/data received from industries) & submission to I/C CDC.	10/02/2016
8	Checking of first draft of program structure of all program by curriculum revision committee (CDC) and return to respective program suggesting necessary corrections if any.	17/02/2016
9	Preparation of revised draft, if required, of program structure by the program and submission to CDC.	24/02/2016
10	Search conference for Validation of skills, program structure and course content detailing by all programs at department level.	02/03/2016
11	Course Content detailing of I, II & III sem. courses strictly as per Guideline of Curriculum Revision , information obtained from industries, content detailing format , feedback of MSBTE equiv. committee etc.	11/03/2016
12	Revising program structure, course content based on the outcome of search conference(if required)	19/03/2016

13	Arranging Program-wise Board of studies meeting (PBOS) of all program for courses of all levels by respective Program.	31/03/2016
	Suggestions in PBOS if any to be incorporated for getting approval from PBOS.	
14	Submission of curriculum of I, II & III sem. courses (soft copy) by program head/ “coordinator – curriculum” of program, to I/C CDC.	07/04/2016
15	Finalizing/checking of curriculum of I, II & III sem. courses of all program by Curriculum Revision Committee & submission to respective programs.	14/04/2016
16	Presentation of curriculum structure and courses in BOS meetings.	20/04/2016
17	Presentation of curriculum structure and courses in G.B. meetings	27/04/2016

Table 6.14. Second Phase Action Plan

S.N.	Activity	Period/Date of Completion, upto
1	Course Content detailing of III (if any), IV & V Level. courses strictly as per Guideline of Curriculum Revision , information obtained from industries, content detailing format , feedback of MSBTE equiv. committee etc.	06/06/2016 to 07/08/2016
2	Revising program structure, course content based on the outcome of search conference(if required)	14/08/2016
3	Arranging Program-wise Board of studies meeting (PBOS) of all program for courses of all levels by respective Program.	Up to 24/08/2016
4	Suggestions in PBOS if any to be incorporated for getting approval from PBOS.	
5	Submission of curriculum of IV & V level courses (soft copy) by program head/ “coordinator – curriculum” of program, to I/C CDC.	31/08/2016
6	Finalizing/checking of curriculum of IV & V level courses of all program by Curriculum Revision Committee & submission to respective programs.	01/09/2016
7	Presentation of curriculum structure and courses in BOS meetings.	07/09/2016 08/09/2016
8	Presentation of curriculum structure and courses in G.B. meetings	Before Diwali Vacation

6.2.10 Analysis and Brain Storming at Program Level

As per the action plan, OBE philosophy, guidelines and outcomes of search conference faculties in the program develops the program Structure (PS) and curriculum of courses as a group task.

The draft program structure of Electrical Engineering (Described in chapter 7) and draft curriculum of Basic Electrical Engineering is developed (shown in table 6.16) by CDC as a model for development of various programs PS and curricula.

Table 6.15. Program Structure Level I (sample)

PROGRAM STRUCTURE												
Level I: General Studies												
DIPLOMA IN ELECTRICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	EN101E	English	Nil	03	00	02	04	70	30	50 [@]	25	175
2	EN102E	Communication Skills	Nil	03	00	02	04	70	30	50 [@]	25	175
3	MN101E	Industrial Organization & Management	Min.60 credits	04	00	00	04	70	30	Nil	Nil	100
4	EV101E	Environmental Science	Nil	01	01	00	02	70**	30	Nil	Nil	100
5	RD101E	Rural Development	Nil	00	00	02	01	Nil	Nil	50 [@]	25	75
Total				11	01	06	15	280	120	150	75	625

- Abbreviations:
TH – Theory ; PR- Practical; TU- Tutorial; TEE- Term End Examination; CA- Continuous Assessment
- *Credit Formula: 1 TH Hr. = 1 Credit; 1 TU Hr. = 1 Credit; 2 PR Hrs. = 1 Credit
- Symbolic Representation
** Online Examination, @ Internal Practical Examination, # External Practical Examination, \$ Award of class course.

6.2.11 Development of Vision, Mission and PEOs and Curriculum

Vision and Mission of the Institute is revised by the CDC in consultation with all the programs, industry experts, academic expert and alumni in search conference. Vision,

Mission, PSOs and PEOs of the programs are developed by program itself in consultation with industry experts, academic expert and alumni in search conference. Vision and Mission of the Institute is approved in BOS and GB and Vision, Mission, PSOs and PEOs of the programs are approved in PBOS, BOS and GB.

6.2.12 Approval from AB, PBOS, BOS and GB

Program Structure, Curriculum of Science, Maths and Humanities departments are approved in AB and program specific courses are approved in PBOS of individual departments, Science, Maths and Humanities courses are also put before the PBOS of each program for approval, the suggestions obtained in PBOS are carried out before put it to BOS and all approved courses are put before BOS for approval. The approved curricula are put before GB for final approval. Table shows the details of PBOS, BOS and GB meetings.

6.3 Curriculum Revision at a Glance

• No. of Programs	:	11
• No. of Courses	:	291
• No. of GB Meetings	:	2
• No. of BOS Meetings	:	3
• No. of PBOS Meetings	:	33
• No. of AB Meetings	:	4
• No. of ILC Meetings	:	5
• No. of SCC Meetings	:	4
• No. of Coordinators Meetings	:	5
• Trainings Workshops	:	3
• Individual Department Trainings	:	13
• Search Conference	:	1
• No. of Faculties Involved	:	108
• No. of outside Experts Involved	:	46
• Days Spent for Curriculum Editing	:	26

CHAPTER 7

Model Course Curriculum

Model Course Curriculum of Basic Electrical Engineering is framed by CDC of GPN and circulates among the programs for development of various curricula. The workshop is arranged to describe the contents in it. The details are described below.

7.1 Basic Information

Following introductory information related to course is given in each curriculum.

PROGRAMME : **DIPLOMA IN ELECTRICAL ENGG.**
LEVEL NAME : **ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES**
COURSE CODE : **EE301E**

The unique method is developed for assigning course code for the various courses, which is described in Figure 7.1.

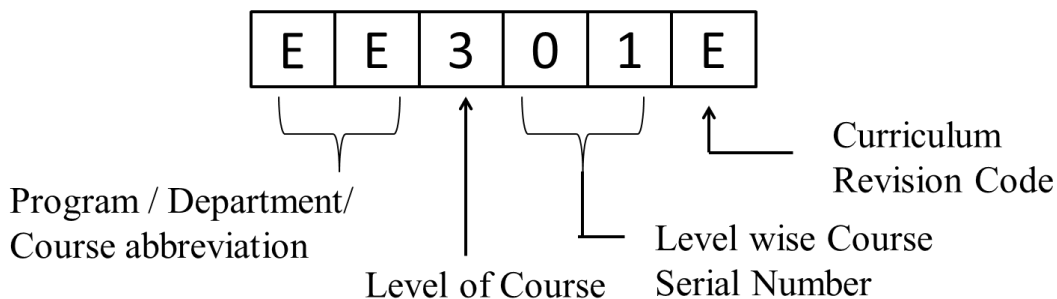


Figure 7.1. Course Code

COURSE TITLE : **BASIC ELECTRICAL ENGINEERING**
PREREQUISITE : **NIL**
TEACHING SCHEME: **TH: 04; TU: 00; PR: 02(CLOCK HRs.)**
TOTAL CREDITS : **05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)**
TH. TEE : **03 HRs**
PR. TEE : **02 HRs (Internal)**
PT. : **01 HR**

7.2 Rationale

In rationale the importance of the course is described in brief.

7.3 Course Outcomes (COs)

COs are “Building Blocks” of OBE system. COs are measured at the end of the course. They are aligned with one or more POs and are closely related to the assessments. COs are measurable and assessable. Every course is having six COs.

Blooms taxonomy is important in higher education, where outcomes needs to be address the student ability to use information, not just recall, therefore all course outcomes are written in higher levels of learning. COs are based on all domains of learning to fulfill maximum POs and start with the action verb. The example of CO is given below showing domains of learning. CO1, CO2 and CO3 are in cognitive domain. CO4, CO5 and CO6 are in psychomotor domain. CO3 falls also under affective domain.

1. **Apply** electrical safety concept
2. **Use** principle and basic laws in electrical engineering for different applications
3. **Solve** simple electrical circuits.
4. **Connect** electrical measuring instruments in the circuit
5. **Record** the readings of various electrical meters.
6. **Operate** electrical equipment.

7.4 Course Details: Theory

Course content is limited to six units. Each unit is having topic and subtopic. Based on the content Specific Learning Outcomes (SLOs) in cognitive Domain are mentioned. Action verbs of Cognitive Domain in all levels of learning;

1. Knowledge,
2. Comprehension,
3. Application, Analysis, Synthesis, Evaluation.

These SLOs are in line levels of learning domains mentioned in specification table or vice versa. Table 7.1 shows example.

Table 7.1. Course Details Theory (sample)

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Electrical Safety	1. Apply electrical safety rules while working 2. Remove the electrocuted person from live conductor 3. Interpret electrical safety signs and symbols 4. Apply different methods of artificial respiration on electrocuted person 5. Select fire-fighting equipment on different types of fires.	1.1 Electrical Safety, Causes of accidents, General safety rules, Concept of electrical shock, Effect of electric shock, Method of removing electrocuted person, Safety signs and symbols. 1.2 Artificial respiration-schaefer's method, silvester's method, mouth to mouth respiration. 1.3 First Aid 1.4 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B,C, D, Fire fighting equipments, fire extinguishers, and their types .	06

7.5 Course Details Practical

All Specific Learning Outcomes (SLOs) are in psychomotor domain to develop the practical skills. Table 7.2 shows example.

Table 7.2. Course Details: Practical (sample)

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Identify electrical measuring instruments, sources, ICDP/ITDP, switches, loads, wires and execute safety precautions in laboratory.	1. Electrical Safety	4
2	Connect voltmeter, ammeter and wattmeter in electrical circuit.	2. Fundamentals of electricity	2
3	Measure the current, voltage and resistance with the help of multi-meter or tong tester.		2
4	Find unknown resistance using ohms law.		2
5	Find temperature coefficient of materials.		2

Skill test is mandatory to assess the skills acquire during the course work before term end examination.

7.6 Specification Table

Specification table is a blue print for setting question paper. It is useful for designing a valid question paper. In OBE 2016 curriculum; specification table is provided for question paper setting (as well as for student); which shows the level wise cognitive process dimensions. The sample Specification table is shown on table

Table 7.3. Specification Table (sample)

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Electrical Safety	00(02)	04(00)	00(00)	04(02)
02	Fundamentals of Electricity	06(02)	08(08)	06(00)	20(10)
03	DC Circuits	02(00)	04(00)	06(06)	12(06)
04	Electrostatics	02(00)	06(04)	00(00)	08(04)
05	Magnetism and Electromagnetism	06(04)	04(08)	06(00)	16(12)
06	AC Fundamentals	02(00)	08(00)	00(06)	10(06)
	Total	18(08)	34(20)	18 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

It is suggested that for:

- Basic Courses: R=30%; U=50%; A=20%
- Higher Level Courses: R=20%; U=50%; A=30%

7.7 Question Paper Profile (QPP)

Question paper profile (QPP) is the steps to words the step of e-governance. We can generate the question paper using computer program with the help of QPP and question bank on each bit of QPP. QPP is also the ready reckoner to the setter for setting questions on different levels of cognitive domain and topics. QPP reduces the process time of printed Question Paper for Examination.

Table 7.4. Question Paper Profile (sample)

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	1	R	2	5/7
	2	R	2																
02	2	R	4	1	U	4	2	U	4	2	U	4	2	U	4				3/5
03	5	R	4	2	U	4	3	U	4	4	U	4	5	U	4				3/5
04	5	U	4	6	U	4	6	U	4	5	U	4	5	R	4				3/5
05	4	U	6	2	A	6	3	A	6										2/3
06	3	A	6	5	A	6	6	A	6										2/3

2 Marks Bit- 5(2) = 7 Bits

4 Marks Bit- 9(6) = 15 Bits

6 Marks Bit- 4(2) = 6 Bits

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

7.8 Assessment and Evaluation Scheme

A detailed assessment and evaluation scheme is mentioned in curriculum in tabulated form as mentioned in table 7.5, which is self-explanatory.

Table 7.5. Assessment and Evaluation Scheme (Sample)

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Scripts	1, 2, 3
		Class Room Assignments		Assignments	10	--	Assignment Book	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Scripts	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	ST	Students	One skill test at end of term	20	--	Practical Answer Scripts	4,5,6
		Journal Writing		Assignments	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Practical Answer Scripts	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course Survey			End Of The Course	Questionnaires			

7.9 Scheme of Practical Evaluation

A detailed scheme of practical evaluation is mentioned in curriculum having practical examination in tabulated form, which is a guideline for development of rubrics for assessment purpose. A sample scheme of practical evaluation of EE301E is shown in table 7.6.

Table 7.6. Scheme of Practical Evaluation (Sample)

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment's. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva voce	10
	TOTAL	50

7.10 Mapping of Course Outcomes with POs and PSOs

All developed curricula are mapped with POs and PSOs of the program. The POs and PSOs which fulfilled by the curriculum content are identified first. Individual course outcomes written previously are then mapped with the POs and PSOs. A sample mapping of EE301E is shown in table 7.7.

Table 7.7. Mapping of COs with POs and PSOs (Sample)

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	-	-	-	-	1	-	-	-	3	3
CO2	3	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	-	-	2	2	2	3	3
CO5	3	3	2	2	-	-	-	2	2	2	3	3
CO6	3	3	2	2	-	-	-	2	2	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

7.11 Reference & Text Books

A reference and text books required as per the content of curriculum are mentioned as a reference for the student as well as faculties. Only standard books having ISBN numbers are given priority in the document. A sample of EE301E is shown in table 7.8.

Table 7.8. Reference & Text Books (Sample)

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Principle of Electrical Engineering and Electronics	V.K. Mehta, S. Chand & Company Ltd., Reprint, 1996	81-219-1053-6
2.	A Text Book Of Electrical Technology Vol-I	B.L.Theraja, A.K.Theraja, S. Chand & Co Ltd., Reprint,2006	81-219-2440-5
3.	Basic Electrical Engineering	V.N.Mittle, Arvind Mittal, The McGraw Hill Education Pvt. Ltd, Reprint, 2011	13: 978-0-07-059357-2
4.	Experiments in Basic Electrical Engineering	S.K.Bhattacharya and K.M.Rastogi., New Age International Publisher, Reprint, 2009.	978-81-224-1042-6
5.	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

7.12 E-References

E-references as per the content of curriculum are mentioned as a reference for the student as well as faculties. Standard e-references are given priority in the document. These references are useful for students learning. A sample of EE301E is shown below.

- <http://nptel.ac.in/courses/108108076/1> , assessed on 18th January 2016
- <http://www.electrical4u.com> , assessed on 18th January 2016
- <https://www.youtube.com/watch?v=A9KSGAnjo2U>, assessed on 18th January 2016

7.13 List of Major Equipment's/Instruments with Specification

The list of major equipment's/ instruments required for performing the practical to developed psychomotor skills is mentioned in the document. A sample list of EE301E is shown below.

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. Wattmeter 0-3000 W
4. Digital Multi-meter
5. Rheostat assorted sizes
6. Variable Inductor

7.14 List of Experts & Teachers who Contributed for Curriculum

The list of experts & teachers who contributed for curriculum is mentioned in the document followed by the signature of chairman PBOS and member secretary of PBOS for the authenticity of the curriculum.

S.N.	Name	Designation	Institute / Industry
1.			
2.			

 Sign. _____
 (Member Secretary PBOS)

 Sign. _____
 (Chairman PBOS)

CHAPTER 8

Curriculum Document

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

8.1 Vision of Institute

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

8.2 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.

8.3 Vision of Program

Vision of the Mechanical Engineering Program:

Impart quality education to create world class Technical Professionals and Entrepreneur to meet the changing need of Industries and Society.

8.4 Mission of Program

Mission of the Mechanical Engineering Program:

M1: To develop and deliver quality academic programs in Emerging field of Mechanical Engineering to empower the students to meet industrial needs with environmental concern.

M2: To adopt the best Instructive methods to maximize knowledge transfer.

M3: To provide the best facility, infrastructure and environment to the students and faculty members, creating an ambience conducive for excellence in Mechanical Engineering education.

M4: To impart quality education to inculcate moral values, professional ethics and Entrepreneurial qualities.

8.5 Program Educational Objectives (PEOs)

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

PEO1: To provide a strong background of science and humanities in order to use these tools in Mechanical Engineering.

PEO2: To develop the ability to demonstrate technical and administrative competence.

PEO3: To develop innovative ideas of recent technology for benefits of society with environmental concern.

PEO4: To attain professional excellence through life-long learning and produce supervisors who ensure ethical and moral behaviour.

PEO5: To develop the qualities of Entrepreneur and professional leader.

8.6 Program Outcomes (POs)

PO1: Basic Knowledge: Ability to apply knowledge of basic Mathematics, Science and Engineering to solve the engineering problems

PO2: Discipline Knowledge: Ability to discipline specific knowledge to solve core and/or applied engineering problems

PO3: Experiments and Practice: Ability to plan and perform experiments and practices and use the results to solve engineering problems

PO4: Engineering tools: Apply appropriate technologies and tools with an understandings of limitations

PO5: The Engineer and Society: Demonstrate knowledge to assess the societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to engineering practice.

PO6: Environment and Sustainability: Understand the impact of engineering solutions in societal and environmental context, and demonstrate knowledge and need for sustainable development.

PO7: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO8: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse/ multidisciplinary teams.

PO9: Communication: An ability to communicate effectively.

PO10: Life-long learning: Recognise the need for, and have preparation and the ability to engage in independent and life-long learning in context of technological changes.

8.7 Program Specific Outcomes (PSOs)

PSO1: Plan, Design, fabricate, test, operate mechanical systems and processes

PSO2: Apply modern tools in manufacturing or processing quality products

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

8.8.1 Mapping of Vision and Mission

Table 8.1. Mapping of Vision-Mission

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

8.8.2 Mapping of Mission and PEOs

Table 8.2. Mapping Mission-PEOs

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

8.8.3 Mapping of PEOs and POs- PSOs

Table 8.3. Mapping PEOs-POs & PSOs

PEOs	Program Outcomes (POs)										PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO2
PEO1	✓										✓	
PEO2		✓	✓	✓				✓				✓
PEO3		✓	✓	✓				✓		✓		✓
PEO4							✓	✓	✓		✓	
PEO5					✓	✓					✓	

8.9 Identified Skills in Search Conference

8.9.1 Technical skills for Mechanical Engineering Diploma Students

1. Prepare engineering drawings using codes, norms and standards manually as well as through CAD software.
2. Visualize three dimensional objects and draw isometric projections
3. Apply knowledge of projections of points and solve the problems on projections of straight lines
4. Sketch sectional and missing views
5. Draw projections of lines, planes, solids and section of solids.

6. Draw and interpret projection of auxiliary views and development of surfaces and intersection of solid as per SP46
7. Draw the details and assembly of machine components
8. Create solid modeling
9. Modify and generate drawings and Print it
10. Prepare simple jobs correctly according to given specification using various tools, measuring instruments and machines for different operations in fitting, smithy, carpentry, pipefitting and metal joining shop.
11. Measure surface finish and dimensional parameter of component
12. Use destructive and nondestructive testing methods.
13. Compare various concepts of Statistical Quality Control
14. Measure different parameters of process and error estimation.
15. Use foundry materials and simple equipments to cast ferrous and non ferrous materials using material technology and strength of material.
16. Use arc, gas and spot welding and cutting processes to prepare simple jobs.
17. Use TIG, MIG, SAW and other advance welding and cutting processes to prepare simple jobs.
18. Use hot and cold working equipments for rolling and forging processes to produce parts using material technology and strength of material.
19. Use conventional machine tools. (lathe, Milling, Shaper, Drilling, Slotting, Planning, Capstans and Turrets, Automates, Grinding, Broaching, Jig boring, Gear hobbing, Gear shaping, Special Purpose Machine tools,etc.)
20. Use presses and press tools.
21. Use Nonconventional machine tools.
22. Use heat treatment processes.
23. Use surface coating and protection methods.
24. Use software like AutoCAD, Pro/E etc to prepare and analyze solid models.
25. Apply concepts of Group Technology, Just in Time, Industrial Engineering
26. Apply concept of concurrent engineering to develop advance manufacturing systems (Like Flexible manufacturing system, Computer Integrated manufacturing, Robotics etc).
27. Use electrical and electronic elements/systems to actuate mechanical mechanism.
28. Apply concept of thermodynamics to boilers, steam turbines, air compressors
29. Apply concept of thermodynamics to IC engines, refrigeration

30. Use power plant equipments (high pressure boilers, Turbines-gas, steam, water, etc) related systems and controls.
31. Use various instruments to measure heat/air related parameters.
32. Use energy conservation and Non conventional Energy System.
33. Apply principles of Fluid Machines and its recommendation for application
34. Use hydraulic equipments comprising of hydraulic elements (pumps, motors, valves, cylinders etc).
35. Use pneumatic equipments comprising of pneumatic elements (Compressor, motors, valves, cylinders, etc).
36. Select elements and construct simple hydraulic and pneumatic circuits.
37. Identify and locate the links in Mechanism.
38. Recognize various components of brakes , dynamometer and power transmission devices.
39. Operate centrifugal governor, belt drives and mechanisms.
40. Observe and report writing of I.C. engine components through visit.
41. Design and modify simple machine elements like links/link mechanisms, fasteners, knuckle joint, cotter joint, riveted joints, levers, etc.
42. Design and modify simple machine elements like shafts, springs, screw jack etc.
43. Use antifriction bearings.
44. Design and draw machine elements like gears, pulleys, clutches, bearings etc.
45. Use cutting tools for machines and machine tools.
46. Design and prepare jigs, fixtures, pattern, mould and press tools for production purposes.
47. Interpret construction and working of steam generator/turbine.
48. Sketch proportional free hand sketches of machine components.
49. Construct cam profile and velocity acceleration diagram.
50. Use cost reduction techniques.
51. Calculate performance parameters in I.C. Engine / Air compressor.
52. Prepare process plan for given part.
53. Carry out work measurement and method study to improve productivity.
54. Select and use quality assurance (Quality control, SQC, Acceptance sampling, TQM,TQC,ISO standards, etc) techniques.
55. Use industrial engineering concepts to improve productivity and quality.(JIT, Reengineering, Value engineering etc)

56. Use entrepreneurship abilities to start any venture successfully.
57. Plan, use and control resources optimally and economically. (Man, Machine, Material, Method, Money, Message-information)
58. Interpret factory acts and laws, relevant social laws.
59. Use innovative and creative approaches and skills for defining and improving/solving industry/institute/ real life problems.
60. Develop ability to dismantle and assemble I.C. Engine
61. Measure the performance of hydraulic machines.
62. Select proper material handling system
63. Prepare maintenance schedule of material handling equipments
64. Appraise of modern trends in the field of refrigeration and air conditioning
65. Calculate COP of Refrigeration system
66. Find fault and select remedy in refrigeration system.
67. Interpret various components of CNC program
68. Develop and execute CNC program
69. Operate CNC Machines
70. Appraise Computer Aided Manufacturing
71. Select suitable energy sources
72. Diagnose the faults in automation
73. Identify various automated process, machines and equipments
74. Select suitable major control components for automation.
75. Illustrate different modes of heat transfer
76. Analyze the heat transfer rate
77. Use various heat exchangers in industrial/domestic application
78. Select proper engineering materials for specific application.
79. Choose different heat treatment processes.
80. Identify different microstructures of steel and cast iron
81. Prepare sample for microscopic examination.
82. Conduct different metallurgical tests on ferrous and non ferrous metals and alloys.
83. Develop method of commencement of project work
84. Use innovative, economic and technological viable solution to the world of work.
85. Use soft skills acquired by the student during their course of work.
86. Develop and present own technical knowledge, self- learning abilities, creativity, and team working abilities.

- 87. Develop an understanding of the behaviour of material and components subjected to various types of loading
- 88. Analyse and design engineering problems subjects to various forces.
- 89. Analyse behaviour of material till fracture and analyse its failure pattern

8.9.2 Generic skills for Mechanical Engineering Diploma Holder

- 1. Identify the problem and apply innovative, creative and logical approach for problem solving.
- 2. Develop the lifelong learning attitude.
- 3. Use techniques to deal effectively with people in the direction of organizational goals.
- 4. Maintain values, positive attitude and interpersonal relations.
- 5. Communicate effectively orally and in writing. Express views precisely, effectively and positively.
- 6. Use soft skills acquired by the student during their course of work.
- 7. Manage time for a given work
- 8. Work under constraints
- 9. Develop conflict resolution skills.
- 10. Develop qualities of Emotional Intelligence.
- 11. Use the skills of giving and receiving Feedback for improving performance
- 12. Encourage the subordinates to ask the questions.
- 13. Develop and present own technical knowledge, self- learning abilities, creativity, and team working abilities

8.10 2011 Curriculum Mapping with Program Outcomes (POs)

The 2011 curriculum is mapped to identify Program strengths (attributes that are widely addressed) and Gaps (attributes that are addressed by only a few learning experiences). The mapping table is shown below.

Table 8.4. 2011 Curriculum Mapping with POs & PSOs

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
	Basic Knowledge	Discipline Knowledge	Experiments and Practice	Engineering tools	The Engineer and Society	Environment and	Ethics	Individual and Team work	Communication	Life-Long Learning	Plan, Design, fabricate, test, operate mechanical systems and	Apply modern tools in manufacturing or processing quality products
EN1101	X	–	X	–	–	–	–	X	X	X	–	–
AM1301	X	–	X	X	–	–	–	X	–	X	–	–
CH1201	X	–	X	–	–	–	–	X	–	X	–	–
MH1201	X	–	X	–	–	–	–	X	–	X	–	–
ME1301	X	X	X	X	–	–	X	X	X	X	X	–
WS1301	X	–	X	X	–	–	X	X	X	X	–	–
EV1101	X	–	–	–	X	X	X	X	X	X	–	–
EN1102	X	–	X	–	–	–	–	X	X	X	–	–
PH1201	X	–	X	X	–	–	–	X	–	X	–	–
MH1202	X	–	X	–	–	–	–	X	–	X	–	–
ME1302	–	X	X	X	–	–	X	X	X	X	X	X
IT1101	X	–	X	X	–	–	–	X	X	X	–	–
EE1303	X	–	X	X	–	–	X	X	–	X	–	–
EC1313	X	X	X	X	–	X	–	X	–	X	X	X
MH1203	X	–	X	–	–	–	–	X	–	X	–	–
ME1401	–	X	X	X	–	–	X	X	X	X	X	–

AM1307	X	–	X	X	–	–	–	X	–	X	–	–
ME1402	–	X	X	X	–	–	X	X	X	X	X	X
ME1413	–	X	X	--	–	–	–	X	–	X	X	X
ME1102	X	–	X	X	–	–	X	X	X	X	X	–
ME1403	–	X	X	X	–	–	–	X	–	X	X	–
ME1412	–	X	X	X	–	X	–	X	X	X	X	–
ME1405	–	X	X	X	–	X	X	X	X	X	X	–
ME1404	–	X	X	X	X	X	X	–	X	X	X	X
WS1401	–	X	X	X	–	–	X	X	X	X	X	X
CM1308	X	–	X	X	–	–	–	X	–	X	–	–
ME1101	X	–	–	–	X	X	X	–	–	X	–	X
WS1402	–	X	X	X	–	–	–	X	X	X	X	X
ME1410	–	X	X	X	–	–	–	X	X	X	X	–
ME1416	–	X	X	X	X	–	–	X	X	X	X	–
ME1504	–	X	X	–	–	X	–	X	–	X	X	–
ME1406	–	X	X	X	–	–	X	X	–	X	X	–
ME1407	–	X	X	X	–	–	X	X	X	X	X	–
ME1418	–	X	X	X	X	X	X	X	X	X	X	X
ME1411	–	X	X	X	–	–	X	X	X	X	X	X
ME1409	–	X	X	X	X	X	X	X	X	X	X	X
ME1408	–	X	X	X	X	X	X	X	X	X	X	X
ME1501	–	X	X	–	X	X	–	–	X	X	–	–

ME1503	–	X	X	X	–	–	–	X	X	X	X	X
ME1508	–	X	X	X	X	–	–	X	X	X	X	X
ME1509	–	X	X	X	–	–	–	X	X	X	X	–

8.10.1 Identified Gaps in 2011 Curriculum

2011 curriculum mapping with Program Outcomes (POs) and Program Specific Outcomes (PSOs) are carried out. It is found that, the content in 2011 curriculum related to following POs are less related to other POs.

1. PO4: Engineering Tools
2. PO5: The Engineer and Society
3. PO6: Environment & Sustainability
4. PO7: Ethics
5. PO9: Communication

Therefore, to fulfill these gaps some common courses and program specific courses are suggested in curriculum

Common Courses:

1. Rural Development
2. Finishing school
3. Industrial Training / Industrial practices
4. Free Electives (Total twelve courses)

Program related courses:

1. Computer Aided Drafting.
2. CNC Machines.

8.11 Courses Identification

Courses are formed based on identified skills in search conference, identified gaps in 2011 curriculum, AICTE guidelines and institute policy framed by ILC. The following table shows the identified skills and courses formed based on it.

Table 8.5. Courses Identification from Identified Skills

T1, T2,T3..... etc indicates Technical skill with serial number mentioned earlier

G1,GT2,G3..... etc indicates Generic skill with serial number mentioned earlier

Identified Skills	Courses
G5- Communicate effectively orally and in writing. Express views precisely, effectively and positively.	1. English
G4- Maintain values, positive attitude and interpersonal relations. G5- Communicate effectively orally and in writing. Express views precisely, effectively and positively. G6- Use soft skills acquired by the student during their course of work.	2.Communication skills
T25- Apply concepts of Group Technology, Just in Time, Industrial Engineering T55- Use industrial engineering concepts to improve productivity and quality.(JIT, Reengineering, Value engineering etc) T56- Use entrepreneurship abilities to start any venture successfully. T58- Interpret factory acts and laws, relevant social laws.	3.Industrial Management
Common Course to fulfil Program Outcomes	4.Environmental Science
Common Course to fulfil Program Outcomes	5. Rural Development
Common Course to fulfil Program Outcomes	3.Computer Applications
Common Course to fulfil Program Outcomes	7. Engineering Physics
Common Course to fulfil Program Outcomes	8. Applied Chemistry
Common Course to fulfil Program Outcomes	9. Engg. Mathematics
Common Course to fulfil Program Outcomes	10Applied Mathematics
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software. T2- Visualize three dimensional objects and draw isometric projections T3- Apply knowledge of projections of points and solve the problems on projections of straight lines T4- Sketch sectional and missing views T48-Sketch proportional free hand sketches of machine components.	11. Engg. Graphics

T10- Prepare simple jobs correctly according to given specification using various tools, measuring instruments and machines for different operations in fitting, smithy, carpentry, pipefitting and metal joining shop.	12. Workshop Practice
Common Course to fulfil Program Outcomes	13. Engg. Mechanics
T27 - Use electrical and electronic elements/systems to actuate mechanical mechanism.	14. Elements of El. Tech.
T27 - Use electrical and electronic elements/systems to actuate mechanical mechanism	15. Electronics & Mechatronics
T78- Select proper engineering materials for specific application. T79- Choose different heat treatment processes. T80 Identify different microstructures of steel and cast iron T81- Prepare sample for microscopic examination. T82- Conduct different metallurgical tests on ferrous and non ferrous metals and alloys.	16. Mech. Engineering Materials
T28- Apply concept of thermodynamics to boilers, steam turbines, air compressors. T30- Use power plant equipments (high pressure boilers, Turbines-gas, steam, water, etc) related systems and controls. T47- Interpret construction and working of steam generator/turbine. T75- Illustrate different modes of heat transfer	17. Thermal Engg.
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software. T4- Sketch sectional and missing views T5- Draw projections of lines, planes, solids and section of solids. T48-Sketch proportional free hand sketches of machine components.	18. Engg. Drawing
T87- Develop an understanding of the behaviour of material and components subjected to various types of loading T88- Analyse and design engineering problems subjects to various forces. T89 Analyse behaviour of material till fracture and analyse its failure pattern	19. Strength of Materials
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software. T6- Draw and interpret projection of auxiliary views and development of surfaces and intersection of solid as per SP46 T7- Draw the details and assembly of machine components	20. Machine Drawing

T37- Identify and locate the links in Mechanism. T38- Recognize various components of brakes , dynamometer and power transmission devices. T39- Operate centrifugal governor, belt drives and mechanisms. T43- Use antifriction bearings. T49- Construct cam profile and velocity acceleration diagram.	21. Theory of Machines
T15- Use foundry materials and simple equipments to cast ferrous and non ferrous materials using material technology and strength of material. T16- Use arc, gas and spot welding and cutting processes to prepare simple jobs. T17- Use TIG, MIG, SAW and other advance welding and cutting processes to prepare simple jobs. T18- Use hot and cold working equipments for rolling and forging processes to produce parts using material technology and strength of material. T21- Use Nonconventional machine tools. T22- Use heat treatment processes. T23- Use surface coating and protection methods. T45- Use cutting tools for machines and machine tools.	22. Manufacturing Processes
T25- Apply concepts of Group Technology, Just in Time, Industrial Engineering T46- Design and prepare jigs, fixtures, pattern, mould and press tools for production purposes. T50- Use cost reduction techniques. T52- Prepare process plan for given part. T53- Carry out work measurement and method study to improve productivity. T57- Plan, use and control resources optimally and economically. (Man, Machine, Material, Method, Money, Message-information)	23. Production Technology
T29- Apply concept of thermodynamics to IC engines, refrigeration T40- Observe and report writing of I.C. components through visit. T51- Calculate performance parameters in I.C. Engine / Air compressor. T60- Develop ability to dismantle and assemble I.C. Engine	24. I.C. Engine
T33- Apply principles of Fluid Machines and its recommendation for application T34- Use hydraulic equipments comprising of hydraulic elements (pumps, motors, valves, cylinders etc). T61- Measure the performance of hydraulic machines.	25. Fluid Power

T19- Use conventional machine tools. (lathe, Milling, Shaper, Drilling, Slotting, Planning, Capstans and Turrets, Automates, Grinding, Broaching, Jig boring, Gear hobbing, Gear shaping, Special Purpose Machine tools, etc.) T20- Use presses and press tools. T21- Use Nonconventional machine tools. T45- Use cutting tools for machines and machine tools.	26. Advance Mfg. Processes
T41- Design and modify simple machine elements like links/link mechanisms, fasteners, knuckle joint, cotter joint, riveted joints, levers, etc. T42- Design and modify simple machine elements like shafts, springs, screw jack etc. T44- Design and draw machine elements like gears, pulleys, clutches, bearings etc.	27. Machine Design
T29- Apply concept of thermodynamics to IC engines, refrigeration T64- Appraise of modern trends in the field of refrigeration and air conditioning T65- Calculate COP of Refrigeration system T66- Find fault and select remedy in refrigeration system.	28. Refrigeration & Airconditioning
T67- Interpret various components of CNC program T68- Develop and execute CNC program T69- Operate CNC Machines	29. CNC Machines
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software. T5- Draw projections of lines, planes, solids and section of solids. T9- Modify and generate drawings and Print it T24- Use software like AutoCAD, Pro/E etc to prepare and analyze solid models.	30. Computer Aided Drafting
T7- Draw the details and assembly of machine components T8- Create solid modeling T9- Modify and generate drawings and Print it T24- Use software like AutoCAD, Pro/E etc to prepare and analyze solid models. T70- Appraise Computer Aided Manufacturing	31. CAD/CAM
T11- Measure surface finish and dimensional parameter of component T12- Use destructive and nondestructive testing methods. T13- Compare various concepts of Statistical Quality Control T54- Select and use quality assurance (Quality control, SQC, Acceptance sampling, TQM, TQC, ISO standards, etc) techniques.	32. Metrology & Quality Control

T11- Measure surface finish and dimensional parameter of component T13- Compare various concepts of Statistical Quality Control T14- Measure different parameters of process and error estimation.	33. Mech. Measurement
T59- Use innovative and creative approaches and skills for defining and improving/solving industry/institute/ real life problems. T83- Develop method of commencement of project work T84- Use innovative, economic and technological viable solution to the world of work. G1- Identify the problem and apply innovative, creative and logical approach for problem solving. G2 Develop the lifelong learning attitude. G6- Use soft skills acquired by the student during their course of work. G7- Use soft skills acquired by the student during their course of work. G8- Work under constraints G13-Develop and present own technical knowledge, self-learning abilities, creativity, and team working abilities	34. Industrial Project
G2 Develop the lifelong learning attitude. G6- Use soft skills acquired by the student during their course of work. G7- Manage time for a given work G11- Use the skills of giving and receiving Feedback for improving performance G13-Develop and present own technical knowledge, self-learning abilities, creativity, and team working abilities	35. Seminar
Common Course to fulfil Program Outcomes	36. Industrial Practices/ Industrial Training
T32- Use energy conservation and Non conventional Energy System. T71- Select suitable energy sources	37. Elective1/1: Renewable energy sources
T72- Diagnose the faults in automation T73- Identify various automated process, machines and equipments T74- Select suitable major control components for automation.	38. Elective ½: Industrial Automation
T31- Use various instruments to measure heat/air related parameters. T75- Illustrate different modes of heat transfer T76- Analyze the heat transfer rate T77- Use various heat exchangers in industrial/domestic	39. Elective2/1: Heat Transfer

application	
T25- Apply concepts of Group Technology, Just in Time, Industrial Engineering T26- Apply concept of concurrent engineering to develop advance manufacturing systems (Like Flexible manufacturing system, Computer Integrated manufacturing, Robotics etc).	40. Elective2/2: CIM
T34- Use hydraulic equipments comprising of hydraulic elements (pumps, motors, valves, cylinders etc). T35- Use pneumatic equipments comprising of pneumatic elements (Compressor, motors, valves, cylinders, etc). T36- Select elements and construct simple hydraulic and pneumatic circuits.	41. Elective3/1: Industrial Fluid Power
T62- Select proper material handling system T63- Prepare maintenance schedule of material handling equipments	42. Elective 3/2: Material Handling
Common Course to fulfil Program Outcomes	43. Finishing School
Common Course to fulfil Program Outcomes	44. Free Electives

8.12

Program Structure

The program structure of the Mechanical Engineering program is developed as described in chapter 6 previously and is given below.

8.12.1 Program Structure Level I: General Studies

Table 8.6. Program Structure Level I: General Studies

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	EN101E	English	Nil	03	00	02	04	70	30	50 [@]	25	175
2	EN102E	Communication Skills	Nil	03	00	02	04	70	30	50 [@]	25	175
3	MN101E	Industrial Management	Min.50 credits	04	00	00	04	70	30	Nil	Nil	100
4	EV101E	Environmental Science	Nil	01	01	00	02	70**	30	Nil	Nil	100
5	RD101E	Rural Development	Nil	00	00	02	01	Nil	Nil	50 [@]	25	75
Total				11	01	06	15	280	120	150	75	625

Abbreviations:

TH – Theory ; PR- Practical; TU- Tutorial; TEE- Term End Examination; CA- Continuous Assessment

Credit Formula: 1 TH Hr. = 1 Credit; 1 TU Hr. = 1 Credit; 2 PR Hrs. = 1 Credit

Symbolic Representations:

** Online Examination,

@ Internal Practical Examination,

External Practical Examination,

\$ Award of class course,

8.12.2

Program Structure Level II: Basic Science Courses

Table 8.7. Program Structure Level II: Basic Science Courses

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	CA201E	Computer Applications	Nil	00	00	04	02	Nil	Nil	50 [@]	25	075
2	PH201E	Engineering Physics	Nil	04	00	02	05	70	30	50 [@]	25	175
3	CH201E	Applied Chemistry	Nil	04	00	02	05	70	30	50 [@]	25	175
4	MH201E	Engineering Mathematics	Nil	04	01	00	05	70	30	Nil	Nil	100
5	MH202E	Applied Mathematics	MH201E	04	01	00	05	70	30	Nil	Nil	100
Total				16	02	08	22	280	120	150	75	625

8.12.3

Program Structure Level III: Engineering Sciences and Technical Arts Courses

Table 8.8. Program Structure Level III: Engineering Sciences and Technical Arts Courses

Level III: Engineering Sciences and Technical Arts Courses

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	ME301E	Engineering Graphics	Nil	02	00	04	04	70	30	Nil	25	125
2	WS301E	Workshop Practice	Nil	00	00	04	02	Nil	Nil	Nil	50	050
3	AM301E	Engineering Mechanics	Nil	03	01	02	05	70	30	50 [@]	25	175
4	EE304E	Elements of Electrical Technology	Nil	04	00	02	05	70	30	50 [@]	25	175
5	EC303E	Electronics & Mechatronics	Nil	04	00	02	05	70	30	50 [@]	25	175
6	MT303E	Mechanical Engineering Materials	Nil	04	00	02	05	70	30	50 [@]	25	175
7	ME303E	Thermal Engineering.	Nil	04	00	00	04	70	30	Nil	Nil	100
Total				21	01	16	30	420	180	200	175	975

8.12.4

Program Structure Level IV: Professional Courses

Table 8.9. Program Structure Level IV: Professional Courses

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
a) Core Courses												
1	ME401E	Engineering Drawing	ME301E	02	00	04	04	70	30	Nil	25	125
2	AM407E	Strength of Material	AM301E	03	01	02	05	70	30	50@	25	175
3	ME402E	Machine Drawing	ME401E	03	00	04	05	70	30	Nil	25	125
4	ME403E	Theory of Machines ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
5	WS401E	Manufacturing Processes ^{\$}	Nil	03	00	04	05	70	30	50#	25	175
6	ME404E	Production Technology	Nil	03	00	00	03	70**	30	Nil	Nil	100
7	ME405E	Internal Combustion Engine ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
8	ME406E	Fluid Power ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
9	WS402E	Advance Manufacturing Processes	Nil	03	00	02	04	70	30	50@	25	175
10	ME407E	Machine Design ^{\$}	AM407E & ME402E	03	00	04	05	70	30	50#	25	175
11	ME408E	Refrigeration And Airconditioning ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
12	ME409E	CNC Machines ^{\$}	WS401E	02	00	02	03	70	30	50#	25	175
13	ME410E	Computer Aided Drafting	ME301E	01	00	04	03	Nil	Nil	50@	25	75
14	ME411E	CAD/CAM	Nil	02	00	04	04	Nil	Nil	50@	25	75
Sub Total (a)				37	01	38	57	840	360	550	325	2075

8.12.5

Program Structure Level IV: Professional Courses (Project Courses)

Table 8.10. Program Structure Level IV: Professional Courses (Project Courses)

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
b) Project Courses												
15	ME412E	Metrology and Quality Control ^{\$}	Nil	00	00	04	02	Nil	Nil	50 [#]	50	100
16	ME413E	Mechanical Measurement	NIL	00	00	04	02	Nil	Nil	50 [#]	50	100
17	ME414E	Industrial Project ^{\$}	100 credits	00	00	04	02	Nil	Nil	100 [#]	50	150
Sub Total (b)				00	00	12	06	Nil	Nil	200	150	350
c) Industrial Interaction courses												
18	SE401E	Seminar	60 credits	00	00	02	01	Nil	Nil	50 [@]	50	100
Any one from following												
19	ID401E	Industrial Training	70 credits	00	00	02	01	Nil	Nil	50 [@]	50	100
	ID402E	Industrial Practices		00	00	02	01	Nil	Nil	50 [@]	50	100
Sub Total (c)				00	00	04	02	Nil	Nil	100	100	200
Total (a) + (b) + (c)				37	01	54	65	840	360	850	575	2625

8.12.6

Program Structure Level V: Elective Courses

Table 8.11. Program Structure Level V: Elective Courses

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
a) Professional Electives (one from each group)												
Group 1												
1	ME501E	Renewable Energy Sources ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
1	ME502E	Industrial Automation ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
Group 2												
2	ME503E	Heat Transfer ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
2	ME504E	Computer Integrated Manufacturing ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
Group 3												
3	ME505E	Industrial Fluid Power ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
3	ME506E	Material Handling ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
Sub Total (a)				12	00	06	15	210	90	150	75	525
b) Free Elective – Non-Technical												
1	FS501E	Finishing School	Nil	00	00	04	02	Nil	Nil	50@	25	75

8.12.7

Program Structure Level V: Elective Courses

Table 8.12. Program Structure Level V: Elective Courses

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
c) Free Electives Technical (Any one) % Not offered for Program ME												
1	FE501E	Basic Building Drawings	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
	FE502E	RAC Maintenance %	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
2	FE503E	Electrical Maintenance	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
3	FE504E	Hobby Electronics	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
4	FE505E	Basic Packaging Technology	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
5	FE506E	Industrial Metallurgical Practices	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
6	FE507E	Computer Network	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
7	FE508E	PC Architecture & Maintenance	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
8	FE509E	Fabric Selection and Care	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
9	FE510E	Two and Four Wheeler Technology	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
10	FE511E	Energy Conservation and Management	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
11	FE512E	Learning Ability Development	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
Sub Total				00	00	04	02	Nil	Nil	50	25	75
Total (a) + (b) + (c)				12	00	14	19	210	90	250	125	675

8.12.8 Program Structure Abstract

Table 8.13. Program Structure Abstract

Abstract

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Level	Course Title Prerequisite courses/credits	No of Courses	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	I	General Studies	5	11	01	06	15	280	120	150	75	625
2	II	Basic Science Courses	5	16	02	08	22	280	120	150	75	625
3	III	Engineering Sciences and Technical Arts Courses	7	21	01	16	30	420	180	200	175	975
4	IV	Professional Courses	19	37	01	54	65	840	360	850	575	2625
5	V	Elective Courses	5	12	00	14	19	210	090	250	125	675
Total			41	97	05	98	151	2030	870	1600	1025	5525

Above program structure approved in PBOS meeting held on 30th march, 2016 for implementation from Academic session 2016-17.

8.13 Award of Class Courses

Table 8.14. Award of Class Courses

DIPLOMA IN MECHANICAL ENGINEERING												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	ME403E	Theory of Machines ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
2	WS401E	Manufacturing Processes ^{\$}	Nil	03	00	04	05	70	30	50#	25	175
3	ME405E	Internal Combustion Engine ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
4	ME406E	Fluid Power ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
5	ME407E	Machine Design ^{\$}	AM407E, ME402E	03	00	04	05	70	30	50#	25	175
6	ME408E	Refrigeration And Airconditioning ^{\$}	Nil	03	00	02	04	70	30	50#	25	175
7	ME409E	CNC Machines ^{\$}	WS401E	02	00	02	03	70	30	50#	25	175
8	ME412E	Metrology and Quality Control ^{\$}	Nil	00	00	04	02	Nil	Nil	50 [#]	50	100
9	ME501E	Renewable Energy Sources ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
	ME502E	Industrial Automation ^{\$}	Nil									
10	ME503E	Heat Transfer ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
	ME504E	Computer Integrated Manufacturing ^{\$}	Nil									
11	ME505E	Industrial Fluid Power ^{\$}	Nil	04	00	02	05	70	30	50#	25	175
	ME506E	Material Handling ^{\$}	Nil									
12	ME414E	Industrial Project ^{\$}	100 credits	00	00	04	02	Nil	Nil	100 [#]	50	150
Total				32	00	32	48	700	300	650	350	2000

8.14 Curriculum at a Glance

Table 8.15. Curriculum at a Glance

SN	CRITERION	RESPONSE
1	Total No. of Courses in a Program	55
2	Total courses required	41
3	No. of courses having Theory papers	29
4	No. of courses having non Theory exam.	12
5	No. of General Studies Courses	5
6	No. of Basic Science Courses	5
7	No. of Engineering Science Courses	7
8	No. of Professional Core Courses	14
9	No. of Professional Elective Courses	3/6
10	No. of Professional Free Elective Courses	2/12
11	No. of Project Courses	3
12	No. of Seminar Courses	2/3
13	Total Credits (1 Th Hr = 1Credit & 2 Pr Hr = 1Credit)	151
14	Total Marks	5525
15	Proportion of Hours (Periods), Th : Pr	51:49 (approx.)
16	Proportion of Credits, Th : Pr	67:33 (approx.)
17	Proportion of Marks; Th : Pr	52:48 (approx.)
18	Total courses for Award of Class	12
19	Total theory paper courses for Award of Class	10
20	Total marks for Award of Class	2000

8.15 Course Flow Diagram

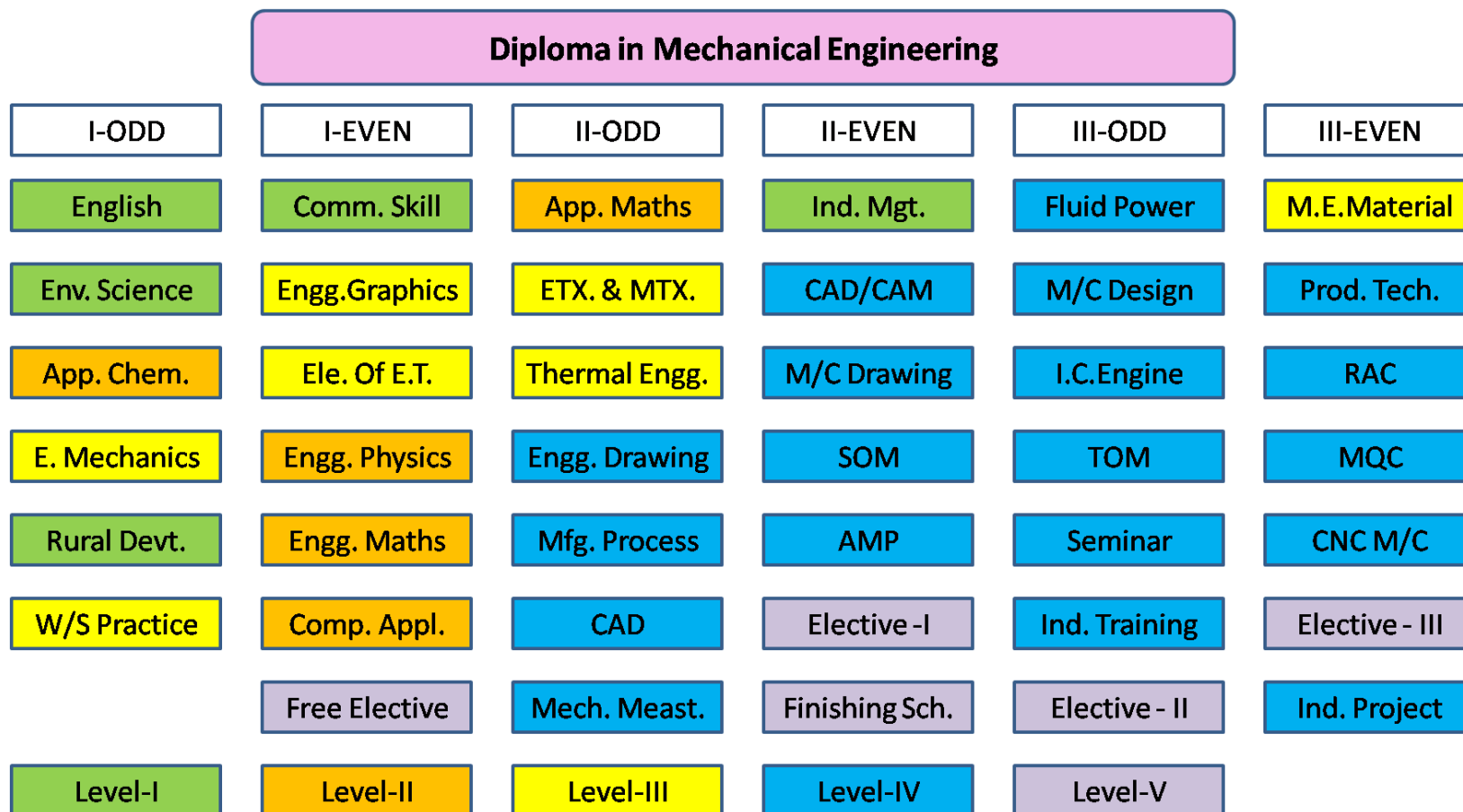


Figure 8.1. Course Flow Diagram

APPENDIX A

Curriculum

LEVEL - I

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE,ME,EE,EC,PK,MT,IT,AE,CM,TX,TR
LEVEL NAME	: GENERAL STUDIES
COURSE CODE	: EN101E
COURSE TITLE	: ENGLISH
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 03TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

❖ RATIONALE:

The basic structure of English through Grammar enhances Holistic development as an individual as well as their role in the world. While teaching this course, complete emphasis will be laid on enhancing expression of ideas in English by the students. Excellence in this language enables a technician to develop his professional career as well as a strong standing in society.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Construct grammatically correct sentences.
2. Express ideas effectively in oral and written form.
3. Enhance comprehending abilities.
4. Develop interest in and appreciate literature.
5. Use social skills and be conversant.
6. Speak sentences with correct intonations.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Application of Grammar	1. Identify grammatical rules to form correct sentences. 2. Use correct sentence pattern in writing and speaking. 3. Enrich vocabulary. 4. State and identify various tenses to be used in a situation.	1.1 Articles :Appropriate use of definite and indefinite articles 1.2 Prepositions: To use correct prepositions as per context. 1.3 Phrases: Combining words to form various phrases. 1.4 Tenses: Appropriate uses of tenses in given situations. 1.5 Voice: use of active and passive voice. 1.6 Narration: Conversion of direct and indirect speech.	12
2. Text	1. Present oral summary of topics read or heard. 2. Adjust speed of reading. 3. Follow oral instructions and interpret them to others 4. Present summary of topics read and heard.	2.1 Text: Learning to read fluently and to develop insight through prose and poetry. Selected prose and poetry prescribed in the text. 2.2 Prose: 1. Positive Thinking- By Stephen 2. Vision 2020- Dr. A.P.J. Abdul Kalam. 3.What India Wants: A.Our muddled Generation- DineshKumar. B. Employers want Employees not Exam results –Manish Sabharwal. 4. The Last Cab Ride- Kent Newburn 2.3 Poem: 1.Kalahandi-Jaganath Prasad Das 2.Money Madness-D.H. Lawrence 3. Where the mind is without fear- Rabindranath Tagore. 4. Voice of the unwanted Girl-Sujata Bhatt.	16
3. Success stories And Seen passages for Comprehension.	1. Take down lecture notes while listening. 2. Write single or multiple sentences. 3. Comprehend main ideas and reproduce them. 4. Ask pertinent question as well as to answer them.	3.1 Success stories:(selected Two success stories from text) 1."It happened in India" Kishor Biyani 2. Aditya Kumar Birla. 3.2 Comprehension: (Selected two passages from the text)	06

4. Vocabulary Building	1. Use word formation devices. 2. Use new words in sentences. 3. Read/write new words from various media. 4. Enrich vocabulary through reading.	4.1 Synonyms and Antonyms 4.2 One word substitution. 4.3 Using words and expressions appropriate to audience.(peers, superiors, subordinates and others)	04
5. Conversational Practice.	1. Use correct pronunciations 2. Pronounce the words correctly. 3. Speak sentences with correct intentions. 4. Use correct accent/stress for the words.	Sample situations for conversational practice. 5.1 Introducing yourself and others. 5.2 Meeting and parting. 5.3 Requests 5.4 Inquiries and information. 5.5 Asking, Giving and Refusing Permission. 5.6 Apologizing.	04
6 Writing Techniques.	1. Expand ideas into paragraphs 2. Prepare speeches as per situations 3. Connect multiple sentences.	6.1 Paragraph writing: Elaborate and expand ideas. 6.2 Speech writing: Welcome speech, Farewell speech, Introducing the guests and vote of thanks.	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Tense Busters -All levels(To be performed in language lab)	Application of Grammar)	04
2.	Reading and making notes	Prose	02
3.	Summarizing poems	Poetry	02
4.	Reading and making notes	Short stories	02
5	Reading and making notes	Prose	02
6	Comprehending passage	Comprehension passage	02
7	Issues in English(to be performed in language lab)	Vocabulary building	06
8	Formal conversations-Telephonic ,Video conferencing	Conversation practice	02
9	Introducing –self and others	Conversation practice	02
10	Observation of oratory speeches of renowned speakers	Conversation practice	02
11	Preparing speech and presenting	Writing techniques	02
12	Writing a paragraph on given topic	Writing techniques	02
Skill Assessment			02
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Application of Grammar	06(04)	06(04)	00(00)	16(12)
02	Text	04(04)	16(04)	06(00)	26(08)
03	Short stories	04(04)	08(04)	00(00)	08(04)
04	Vocabulary Building	04(00)	04(04)	00(00)	08(04)
05	Conversational Practice	00(00)	00(00)	06(06)	06(06)
06	Writing Techniques	00(00)	00(00)	06(06)	06(06)
	Total	18(12)	34(16)	18 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Application

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	U	2	1	U	2	1	U	2	1	U	2	1	U	2	1	U	2	5/7
	1	R	2																
02	2	U	4	2	R	4	2	R	4	2	U	4	2	U	4				3/5
03	3	U	4	3	U	4	2	R	4	2	R	4	3	U	4				3/5
04	4	R	4	4	A	4	1	R	4	1	R	4	1	U	4				3/5
05	5	A	6	5	A	6	5	U	6										2/3
06	6	A	6	6	A	6	6	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Performance	05
2	Overall presentation of given assignment	05
3	Viva voce	10
4	Activity	05
	TOTAL	25

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	3	-	-	-	-	-	3	3	-	-
2	3	-	3	-	-	-	-	-	3	-	-	-
3	-	-	3	-	-	-	-	-	3	3	-	-
4	-	-	3	-	-	-	-	-	-	-	-	-
5	-	-	3	-	-	-	1	1	3	3	-	-
6	3	-	3	-	-	-	-	1	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Positive Thinking	Stephen, Inspirational Stories ,June 2011	-
2	Vision 2020	Dr.A.P.J. Abdul Kalam 'Prism', Macmillan Publication.	1403928282
3	What India Inc-	Dinesh Kumar, Manish Sabharwal, Golden Harvest,	9788125059523
4	The Last Cab Ride	'Life', by Stephen	-
5	Kalahandi	Jaganath Prasad Das, Reflection on vital issues', by P.J.George	9788125041764
6	Money Madness	D.H.Lawrence by P.J.George Orient Blackswan 2010	9788125041764
7	Where the mind is without fear	Rabindranath Tagore Prism, Macmillan Publication	1403928282

8	Voice of the unwanted girl	Sujata Bhatt Prism, Macmillan Publication	1403928282
9	High School English Grammar and Composition	Wren and Martin Revised by Dr.N.D.V. Prasada Rao, S.Chand Publication.	81-219-0009-3
10	Business communication	Urmila Rao Himalaya Publication, 2011	81-8318-438-3
11	Contemporary English Grammar-structure and composition	David Green Revised Edition,2004 Himalaya Publication	033392183-6
12	Interactive English	S.K.Gangal, Revised Edition 1997 Allied Publishers	81-7023-678-9
13	Applied English Grammar and composition.	Dr. P.C. Das, 2013, New Central Book Agency.	978-81-7381-542-3
14	English for Practical Purposes	Z. N. Patil, B.S. Valke	033935098

❖ **E-REFERENCES:**

www.talkenglish.com-grammar , assessed on 12th March, 2016

www.edufind.com-englishgrammar ,assessed on 12th March, 2016

www.perfect-english-grammar.com, assessed on 12th March, 2016

www.yosuccess.com, assessed on 13th March, 2016

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. Sadiya Raza	Lecturer in English & Coordinator	Government Polytechnic, Nagpur.
2.	Dr. Nutan Chotai	Expert, Head of Dept.	LAD College, Nagpur.
3.	Mrs. K.N. Deshmukh	Expert, Head of Humanities	SDMP, Nagpur.
4.	Dr. Shilpa Sarode	Expert, Asst. Professor	LAD, Nagpur
5.	Mrs. M.M. Machale	Lecturer in English	Government Polytechnic, Nagpur.
6.	Ms. Humeera Quraishi	Visiting Lecturer in English	Government Polytechnic, Nagpur.
7.	Ms. Marlyn Fernandes	Visiting Lecturer in English	Government Polytechnic, Nagpur.
8.	Ms. Nazish Ahmed	Visiting Lecturer in English	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA INCE,ME,EE,EC,PK,MT,IT,AE,CM,TX,TR
LEVEL NAME	: GENERAL STUDIES
COURSE CODE	: EN102E
COURSE TITLE	: COMMUNICATION SKILLS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 03 TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM.	: 03 HRs
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: 01 HR

❖ RATIONALE:

In this present competitive scenario, proficiency in communication skills is one of the basic needs of technical students. A diploma holder is therefore expected to meet the challenges of communicating with his peers, superiors, subordinates and clients. Communication skills will help him towards achievement of perfection.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply concepts of communication in the given situation.
2. Modify language skills.
3. Execute requisite qualities as per industry requirements.
4. Compose official documentation.
5. Participate in and conduct group discussions and meetings effectively
6. Use correct pronunciations and intonations.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Communication	1. Identify modern concept of communication. 2. Breaks down barriers to communicate effectively. 3. Modify appropriate body language. 4. Derive confidence while conversing.	1.1 Definition, Process, Types: Verbal-Non Verbal, Formal-Informal, Upward-Downward, Horizontal. 1.2 Barriers of communication: Physical, Mechanical, Psychological, Language, Status . Ways to overcome barriers. 1.3 Selection of proper channels of communication. 1.4 Non-verbal communication in detail: Body language, Eye contact, Dress and appearance, color, sound, Gestures, Postures, Pictorial representations.(Maps, Charts ,Graphs)	14
2. Inculcation of various generic skills.	1. Identify their receptive skills to strengthen their productive skills. 2. Derive listening abilities. 3. Use detailed write-ups 4. Participate in conversations.	2.1 Listening and reading skills- Importance of listening skills, levels of listening, Types of reading, Phonetics, IPA 2.2 Speaking and writing – Importance of Pronunciation, Importance of Debate.	08
3. Areas of self-Development.	1. Identify strengths and weakness. 2. Classify different types of motivation in one's life. 3. Plan presentations properly. 4. Modify leadership qualities.	3.1 Aims of self-development, self-awareness with respect to strength and weakness, How to overcome weakness for acquiring self-confidence. 3.2 Motivation –Introduction, Definition, Types with example. 3.3 Presentation skills – Parameters, Appearance, use of body language, Eye contact, content preparation, Depiction of interest of audience. 3.4 Time management- Importance, Process of time planning. 3.5 Team Building and Leadership qualities.	10
4. Development of	1. Plan group discussion. 2. Relate behavior during and post	4.1 Interview Techniques: Preparation, Behavior during interview, post interview. 4.2 Group discussion: Being the first	06

soft skills.	interview. 3. State and justify one's abilities.	member, how to make a general discussion, to give a concrete shape to discussion, purpose.	
5. Business correspondence	1. Identify various types of letters. 2. List down one's qualities by writing resume. 3. Use various reports to express ideas effectively in English	5.1 Letters: Job application and Resume writing Leave letter, Sales letter, Enquiry letter, order letter, complaint letter. 5.2 Report writing: Progress, Accident, Trouble, Feasibility. 5.3 Notices, circular, Memorandum-mail messages.	10
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practic al's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Master the skill of face -to -face communication	Communication	02
2.	Sharpen one's body language while communicating with the help of Extempore/Impromptu.		02
3.	Demonstrate through role-play skills of a good communicator like RJ, News reader, commentator.		04
4.	Master the art of reading, writing, listening skill(to be performed in Language lab using software)	Inculcation of various Generic skills	06
5	Execute the art of Debate		02
6	Transcribe the given words phonetically		02
7	Master the skill of oral presentation by presenting a topic through PowerPoint presentation.	Areas of self-development.	02
8	Demonstrate leadership qualities		02
9	Manipulate Group Discussion by active participation	Development of soft skills	02
10	Build interview techniques through Mock Interview		02
11	Implement the art of writing E-mails and reports	Business correspondence	02
12.	Implement the art of writing Formal drafting's by preparing resume, letters.		02
Skill Assessment			02
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Communication	06(06)	04(04)	06(04)	16(14)
02	Inculcation of various Generic skills among future engineers	02(00)	08(10)	00(06)	10(16)
03	Areas of self Development	06(00)	06(06)	06(00)	18(06)
04	Development of soft skills	02(04)	08(00)	00(00)	10(04)
05	Business Correspondence	00(00)	08(04)	08(00)	16(00)
	Total	20(08)	30(20)	20 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	4	R	2	5	A	2	3	U	2	5/7
	1	R	2																
02	1	R	4	1	R	4	2	U	4	2	U	4	5	U	4				3/5
03	3	R	4	4	R	4	2	U	4	3	U	4	5	U	4				3/5
04	1	U	4	5	U	4	4	U	4	1	A	4	4	U	4				3/5
05	2	A	6	3	A	6	3	U	6										2/3
06	1	A	6	5	A	6	2	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Performance	05
2	Overall presentation of given assignment	05
3	Viva voce	10
4	Activity	05
	TOTAL	25

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	2	-	3	-	-	-	-	3	3	3	-	-
2	-	-	3	-	-	-	-	-	3	-	-	-
3	-	-	3	-	-	-	-	3	3	3	-	-
4	2	-	3	-	-	-	-	-	3	3	-	-
5	-	-	3	-	-	-	-	3	3	3	-	-
6	-	-	-	-	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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 , Himalaya Publication, First Edition, 2009	978-81-8488-596-5
4.	Secret of face to face communication.	Peter Urs, Bender, 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 McGraw Hills,	13978-0-19-566804-9
7	Modern Commercial Correspondence	R.S.Pillai, Bhagwati, S.Chand & Co.	812190519-2

❖ E-REFERENCES:

www.mindtools.com.au, assessed on 12th March, 2016

www.interviewbest.com, assessed on 12th March, 2016

www.skillsyouneed.com-presentationskills, assessed on 12th March, 2016

❖ LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:

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2.	Dr. Nutan Chotai	Expert, Head of Dept.	LAD College, Nagpur.
3.	Mrs. K.N. Deshmukh	Expert, Head of Humanities	SDMP, Nagpur.
4.	Dr. Shilpa Sarode	Expert, Asst.Professor	LAD, Nagpur
5.	Mrs. M.M. Machale	Lecturer in English	Government Polytechnic, Nagpur.
6	Ms. Humeera Quraishi	Visiting Lecturer in English	Government Polytechnic, Nagpur.
7.	Ms. Marlyn Fernandes	Visiting Lecturer in English	. Government Polytechnic, Nagpur.
8.	Ms. Nazish Ahmed	Visiting Lecturer in English	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/EE/EC/CM/IT/AE/MT/PK/TX
LEVEL NAME	: GENERAL STUDIES
COURSE CODE	: MN101E
COURSE TITLE	: INDUSTRIAL MANAGEMENT
PREREQUISITE	: 50 Credits
TEACHING SCHEME:	TH: 04; TU: 00; PR: 00
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: NIL
PT.	: 01 HR

❖ RATIONALE:

Managing personnel and scarce resources in any organization is one of the primary & most challenging functions in industries. Scientific Management studies have evolved techniques for the same. The success of an enterprise depends upon how effectively the manpower is organized to work. The students of engineering who will be joining as technicians in the industrial organization are expected to have preliminary information about these said procedures

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Illustrate various forms of organization and its necessity and different aspects of entrepreneurship.
2. Analyze different sources of finance for industry to fulfill capital needs.
3. Interpret principles of human resource management, safety engineering and supervisory management along with various industrial acts
4. Illustrate various functions of marketing management and inventory control.
5. Calculate various cost of production, selling price of a product and its depreciation.
6. Analyze concept of TQM and modern techniques of quality control.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Introduction to Management & Entrepreneurship	1. Define Management, Organization, Administration and Entrepreneurship. 2. Compare Management, Organization, Administration. 3. Interpret appropriate type of ownership. 4. Carry out different methods of selection of organization. 5. Define Function of Management. 6. Describe Entrepreneurial qualities/traits. 7. Acquire industrial work culture 8. Describe successful entrepreneurs 9. Select Government subsidies	1.1 Definitions: Management, Organization, Administration and Entrepreneurship. Forms of ownership: Proprietorship, Partnership, Joint stock co. 1.2 Co-operative sector, Public sector, Government Undertaking, Advantages, limitations & Application of each type, comparison between different forms 1.3 Types of Organization: Line, Functional, line & staff organization, Advantages, limitations & Applications of each type, comparison between different types. 1.4 Functions of Management: - Forecasting, Planning, Organizing Directing, Motivating, Controlling, Coordinating, Decision-making, 1.5 Principles of management, Levels of management - Function of each level. 1.6 Entrepreneurship: Concept, Types of Entrepreneur, Characteristics of Entrepreneur, Women entrepreneurship, problem faced by women entrepreneur. 1.7 Case studies on successful entrepreneurs 1.8 Government subsidies for entrepreneur: Expert lecture on it. (No questions should be asked on the subtopic 1.7 & 1.8)	12
2.Financial Management	1. State the need and sources of finance. 2. Define and differentiate Shares and debentures. 3. Construct Break Even point in an Industry. 4. Analyse Break even point 5. Calculate E.O.Q. 6. Compare types of capital. 7. Acquire basics & financial Management techniques.	2.1 Need of Finance and Sources of finance for enterprises -Short term, Medium term and long term sources. 2.2 Shares, debentures, types of shares and Comparison between shares & debentures 2.3 Break Even Analysis- Importance of Breakeven point, E.O.Q. (numerical on EOQ) 2.4 Types of capital: fixed and working capital	10

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
3. Human Resource Management	1. State Concept, aim,& objectives of HRM. Describe Functions of HRM. 2. Interpret the need of welfare & safety, Industrial Hygiene. 3. Define functions of Supervisors. 4. Identify&/choose proper style of supervision. 5. Describe industrial act	3.1 Concept, aim , & objectives of HRM. 3.2 Functions of HRM: planning, organizing, staffing, recruitment, education & training- need, methods of training, , Motivation, controlling, compensation, integration and maintenance. Labour welfare , Industrial relations 3.3 Safety engineering: need, organization, committee, programme, instructions & training. Accidents: causes & prevention. 3.4 Characteristics of supervisors, functions of supervisors and styles of supervision& its advantages and limitations. 3.5 Industrial act: Need, Factory act 1948, ESI act, Workmen compensation act only	10
4. Marketing and inventory management	1. Describe the activities of Marketing Management. 2. State inventory management technique. 3. Use marketing strategies. 4. Select sales promotion and media	4.1 Definition of Market, Functions of Marketing Department 4.2 Marketing strategies, Marketing environment, Consumer behavior, Market research, Market survey, marketing mix. 4.3 Sales forecasting, Sales promotion, advertising, media selection. 4.4 Definition of inventory & inventory control. 4.5 Types of inventory items in industries, ABC and VED analysis only	12
5. Estimation and Costing	1. Define & calculate various cost and expenses involving in Product manufacturing. 2. Calculate the selling price of product. 3. Describe balance sheet. 4. Define& compare depreciation and obsolescence. 5. Describe& Calculating depreciation.	5.1 Product cost determination, Direct Cost and Indirect Cost, Material Cost And Labour Cost, Expenses- Factory and Overheads. 5.2 Determination of Selling Price of product- Profit and Loss Statement, Balance sheet description. 5.3 Depreciation &, Obsolescence- Concept and Comparison. 5.4 Methods of Calculating depreciation- straight line, reducing balance, annuity, sinking fund & sum of the digit methods. (Simple Numericals on subtopic 5.1, 5.2 & 5.4)	10

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
6. Total Quality Management	1. Define terms related to TQM 2. Describe various quality control techniques. 3. Interpret importance of quality circle and ISO 9000 4. Compare ISO9000 and TQM	6.1 Concept and definition of Quality, Quality Control, Quality Conformance and Quality Assurance. 6.2 TQM- Concept and Objectives, Process 6.3 Quality control techniques: Lean Manufacturing -JIT,5”S”, Six sigma, Kaizen, BPR 6.4 Quality Circle and ISO 9000, ISO 14000, ISO 9001: 2015, ISO 14001: 2015, Difference between ISO9000 and TQM,	10
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
Nil			

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01.	Management	04(04)	10(04)	00(00)	14(08)
02.	Financial Management	04(00)	04(06)	04(00)	12(06)
03.	Human Resource Management	02(00)	04(06)	06(00)	12(06)
04.	Marketing And Inventory Management	04(04)	06(00)	00(04)	10(08)
05.	Estimation And Costing	06(04)	04(02)	02(00)	12(06)
06.	Total Quality Management	04(04)	06(00)	00(02)	10(06)
	Total	24(16)	34(18)	12 (06)	70(40)

R – Remember U – Understand A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	2	R	2	3	R	2	1	A	2	5/7
	1	R	2																
02	1	U	4	2	A	4	2	U	4	1	A	4	4	A	4				3/5
03	4	R	4	3	U	4	5	R	4	4	U	4	5	U	4				3/5
04	5	A	4	5	U	4	6	R	4	6	U	4	6	A	4				3/5
05	3	A	6	4	U	6	2	U	6										2/3
06	1	U	6	6	U	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	--	--	--	--
				TOTAL	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	Nil	

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:****For Mechanical Engineering Program:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	–	–	–	–	–	–	–	–	3	3	–
2	3	–	–	–	–	–	–	–	–	3	3	–
3	3	–	–	–	3	2	3	–	–	3	3	–
4	3	–	–	–	3	–	3	–	–	3	3	–
5	3	–	–	–	3	–	3	–	–	3	3	2
6	3	–	–	–	3	2	3	–	–	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

For Other than Mechanical Engineering Program:

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	–	–	–	–	–	–	–	–	3	–	–
2	3	–	–	–	–	–	–	–	–	3	–	–
3	3	–	–	–	3	2	3	–	–	3	–	–
4	3	–	–	–	3	–	3	–	–	3	–	–
5	3	–	–	–	3	–	3	–	–	3	–	–
6	3	–	–	–	3	2	3	–	–	3	–	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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 Engineering And Management	O.P. Khanna, Dhanpat Rai, New Delhi, 1980	81-885-9777-5
3.	Industrial organization and management	Lawrence L Bethel & James L Riggs, New York, McGraw-Hill [1971], 6 th , 1979	09-322-3849-1
4.	Industrial Management	I.K.Chopde & A.M.Sheikh, S.Chand & Co. Ltd, Delhi, 2 nd , 1999	81-219-1480-9
5.	Industrial engineering: Organization and management	Tara Chand, Publisher: Nem Chand, 5 th , 1982	B0007BSSB0
6.	Engineering Economics	Tara Chand, Publisher: Nem Chand, 14 th , 2014	81-85240-82-5
7.	Entrepreneurial Development	S.S.Khanka, S.Chand & Co. Ltd, Delhi, 1 st , 1999, reprint 2006	81-219-1801-4

❖ **E-REFERENCES:**

- <http://www.free-management-ebooks.com/index.htm> , assessed on 22th March 2016 .
- <https://www.youtube.com/watch?v=oQ1OTaJ9Sfc&list=PLB628C837430CB736&index=3> assessed on 23th March 2016
- <https://www.youtube.com/watch?v=2PkrT1ko3Yk&list=PLB628C837430CB736&index=10> assessed on 24th March 2016
- <http://www.slideworld.com/pptslides.aspx/industrial-management> assessed on 24th March 2016
- http://www.powershow.com/view/e4cd2mMwY/Industrial_Organization_I_powerpoint_ppt_presentation assessed on 25th March 2016

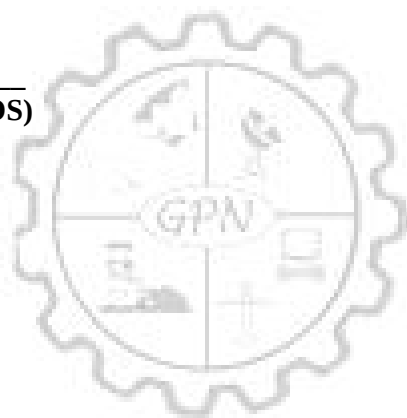
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. V.S Ikhar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mrs. R A Gadekar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. G. H. Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/PK/MT/TX/TR
LEVEL NAME	: GENERAL STUDIES
COURSE CODE	: EV101E
COURSE TITLE	: ENVIRONMENTAL SCIENCE
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 01; TU: 01; PR: 00 (CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 01 Hr. (Objective Type Online Examination)
PR. TEE	: NIL
PT.	: 15 MINUTES (Objective Type offline Examination)

❖ RATIONALE:

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution, poses major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental science, which shall provide an insight into various environment related issues.

Environmental science is an interdisciplinary academic field that integrates physical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems & gives an insight into solutions of Environmental problems

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Define the terms related to Environmental Studies.
2. Identify natural resources and resolve problems associated with them.
3. Identify alternate energy resources and use them efficiently during their engineering practices.
4. Develop habits which will cause less harm to environment
5. Analyze key issues about environment and create public awareness about those environmental issues.
6. Follow environmental ethics as lifelong learning.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs .
1. Earth Systems and Resources	1. Name the historical events of earthquakes, volcanoes, Tsunami, cyclone & landslides in the world. 2. Identify problems associated with soil, water 3. Define weather and climate. 4. Analyze the global water problems.	1.1 Earth Science: Concepts of Geologic time scale; earthquakes, volcanoes , Tsunami , cyclone & landslides 1.2 The Atmosphere: Weather and climate; the Coriolis Effect 1.3 Global Water Resources and Use: Present scenario, surface and groundwater issues; global problems; and its conservation. 1.4 Soil : soil erosion and other soil problems; methods of soil conservation	02
2. Concept of Biodiversity	1. Define Biodiversity 2. List Levels of biodiversity 3. Define and list the biodiversity hotspots 4. List the endangered species 5. Prepare a report on value of Biodiversity 6. Suggest methods /steps for Biodiversity conservation	2.1 Definition of Biodiversity 2.2 Levels of biodiversity 2.3 Value of biodiversity 2.4 Threats to biodiversity, loss of biodiversity (biodiversity hotspots) 2.5 Conservation of biodiversity (modern methods of biodiversity conservation)	02
3. Energy Resources and Consumption	1. Match the energy forms projects 2. List various forms of energy 3. State advantages and disadvantages of forms of energy 4. Select appropriate solutions of Efficient Use energy 5. Utilize techniques for energy consumption to reduce impact on environment.	3.1 Energy Consumption history 3.2 Present global energy use, Future energy needs 3.3 Energy forms:(conventional and non conventional) 3.4 Energy Conservation 3.5 Renewable Energy: Solar energy; solar electricity; biomass; wind energy; ocean waves and tidal energy; geothermal	03
4. Pollution	1. Define pollution and pollutants 2. List the types of pollutants. 3. Identify the Pollutants and their sources 4. Develop habits to reduce pollution 5. State the standard / limiting/ controlling values	4.1 Definition of pollution. 4.2 Air pollution: Definition, Classification, sources, effects, Prevention and ambient air quality standards. 4.3 Water Pollution: Definition, Classification, sources effects, Prevention And WHO and BIS water quality standards.	04

	of various types of pollution.	4.4 Soil Pollution/land pollution: Definition, sources, effects, prevention 4.5 Noise Pollution: Definition, sources, effects, prevention. 4.6 Biomedical Waste and E-Waste -- Origin, Effects and control Measures. 4.7 CPCB and MPCB norms and roles and responsibilities.	
5 Social Issues and Environment	1. Define sustainable development 2. Evaluate sources of Green house effect, acid rains, Global warming 3. List the incidences of Nuclear Accidents,	5.1 Concept of development, sustainable development 5.2 Watershed management , rain water harvesting 5.3 Global Warming, greenhouse effect; ozone depletion, relevant laws and treaties 5.4 Nuclear Accidents and Holocaust: Basic concepts and their effect on climate, , relevant laws and treaties	03
6. Environmental Education	1. Differentiate between formal and non formal education 2. List the various acts and their provisions 3. Develop awareness about environment.	6.1 Formal and non-formal education 6.2 Role of Govt. and Non-Govt. Organization 6.3 Indian constitutional provisions regarding the environment. Brief description of the following acts and their provisions: Environmental Protection Act and Prevention of Water, air and noise Pollution Act. 6.4. Concept EIA and environmental Ethics	03
Total Hrs.			16

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Prepare report on Loss of biodiversity, its conservation and also describe biodiversity hotspots.	Concept Of Biodiversity	4
2	Prepare report on use of various renewable energy sources.	Energy Resources And Consumption	4
3	Group discussion and Assignment on article collection from news papers, magazines and internet on local environmental pollution.	Pollution	4
4	Prepare report on case study of Industrial/Nuclear/any other Disaster in India.	Social Issues And Environment	4

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Earth Systems And Resources	02(00)	04(00)	02(00)	08(00)
02	Concept Of Biodiversity	04(00)	08(00)	02(00)	14(00)
03	Energy Resources And Consumption	04(00)	08(00)	04(06)	16(00)
04	Pollution	04(00)	10(04)	06(00)	20(04)
05	Social Issues And Environment	02(00)	04(00)	00(00)	16(12)
06	Environmental Education	02(00)	02(00)	02(00)	06(00)
	Total	18(00)	36(00)	16 (00)	70 (00)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Bit 7		
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M
01 To 35	1	R	2	2	R	2	3	R	2	4	R	2	1	U	2	2	R	2	1	U	2
	3	U	2	2	A	2	1	A	2	2	U	2	3	R	2	4	U	2	2	U	2
	4	A	2	4	U	2	4	U	2	5	R	2	2	U	2	3	U	2	4	R	2
	2	U	2	3	U	2	5	R	2	4	U	2	3	U	2	5	U	2	3	A	2
	4	U	2	3	A	2	4	A	2	6	R	2	6	U	2	6	U	2	4	A	2

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Online Examination Report	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	--	--	--	--
				TOTAL	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

Nil

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	--	--	--	3	3	3	3	--	3	-	-
2	3	--	--	--	--	3	--	--	--	3	-	-
3	3	--	--	--	3	3	--	--	--	3	-	-
4	3	--	--	--	3	3	3	3	--	3	-	-
5	--	--	--	--	3	3	3	3	2	3	-	-
6	--	--	--	--	3	--	3	3	2	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Environmental studies	Oxford University Press, New Delhi. 2011	0-19-807228-2
2.	Environmental Science	Y.K. Singh, New Age International, New Delhi	8122418481, 9788122418484
3.	A Text Book Of Environmental Science	Arvind Kumar, APH Publishing, New Delhi	817648590X, 9788176485906
4.	Environmental Engg	A Kamla & D.L.Kanth Rao, Tata Mc Graw-Hill, New Delhi	0-07-451708-2
5.	A Textbook of Environmental Studies	Shashi Chawla, Tata Mc Graw-Hill, New Delhi	9781259006388

❖ **E-REFERENCES:**

1. https://en.wikipedia.org/wiki/Lists_of_nuclear_disasters_and_radioactive_incident_s, accessed on 20 January 2016
2. www.legalserviceindia.com/articles/noip.htm accessed on 18 March 2016
3. <https://prezi.com/8mnz--ldkybc/apes-unit-1-earth-systems-resources/> accessed on 23 March 2016
4. <http://www.conserve-energy-future.com/AlternativeEnergySources.php>, 18 March 2016

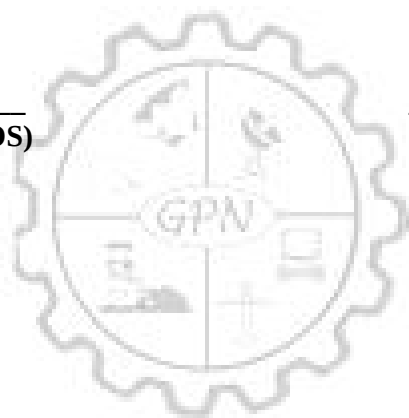
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. S J Patil	Head of Civil Engineering, (I Shift)	Government Polytechnic, Nagpur.
2	R N Giradkar	Head of Civil Engineering, (II Shift)	Government Polytechnic, Nagpur.
3	N. U Sulbhewar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
4	B. R. Ambade	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
5	D. A. Khandare	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
6	Mr. M. R. Shelote	Consultant Engineer	M R Associates, Nagpur
7	Dr. R. N. Khapre	Associate Professor	Ramdeobaba College of Engineering and Management, Nagpur
8	Mr. A. J. Fulzele	Assistant Secretary (Tech.)	MSBTE, RO, Nagpur

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/PK/MT/TX/TR
LEVEL NAME	: GENERAL STUDIES
COURSE CODE	: RD101E
COURSE TITLE	: RURAL DEVELOPMENT
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 02 (CLOCK HRs.)
TOTAL CREDITS	: 01(1TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

India is a rural developing country. About 70 percent of the total inhabitants are living in rural area. The development of India as a whole cannot be possible without development of the rural areas. The Central and state Governments tried to develop rural area through various welfare, health, economic, and social schemes. But it is the moral duty of each urban person to think about the development of rural area.

Young students are said to be new Nation. Therefore, this subject has been introduced so that the students should aware about the rural scenario in India. They should think and work for the overall rural development as per the development indicators prescribed at International level. They should write, and work for the Rural – Urban Linkage to upgrade the rural level.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Interpret Indian development indicators with International level.
2. Use and record questionnaire for rural survey.
3. Apply engineering knowledge for rural economy.
4. Suggest suitable scheme for rural development.
5. Prepare sustainable development plan for rural development.
6. Create suitable environment in rural area for development of every individual.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Write report of Development, Indicators of development, Rank of India in various development indexes (Individual task). Report includes: • Development, Modern Concepts, Indicators of development, • Importance, Scope and Objectives of RD. • Agriculture development, Agricultural allied development, Social and Human Development. • Rank of India in Human development index, Water and Sanitation Index, Shelter index, Education to all indexes, Health and wellness index.	Overview of Rural Development	04
2	Write report related to particular village (Group of 10 students). Survey, observe and evaluate Educational issues, Occupational issues, Agricultural issues, irrigation issues, migration issues, landless issues, Water supply and sanitation issues, Health issues, Poverty issues, Nutrition issues, Unemployment issues, Economy issues, Market for agriculture products issues, in Rural Development. Report includes: • Social structure of Rural India, Educational issues, Occupational issues, Agricultural issues, irrigation issues, migration issues, landless issues, Water supply and sanitation issues, Health issues, Poverty issues, Nutrition issues, Unemployment issues, Economy issues, Market for agriculture products issues, etc	Issues of Rural Development	06
3	Write report related to particular village (Group of 10 students). Survey, observe, evaluate and propagate Rural Development programmes (Sarva Shiksha Mission, Jal Swarajya Scheme, Water shed Management, Gobar Gas Scheme, Water Harvesting, MNREGA etc.) Run by Central and State Govt, according to directive principles in Indian Constitution. Report includes: • Constitutional provisions for Rural Development, Directive Principles. • Schemes of Central and State Govt. for Rural Development. • Role of GOs and NGOs. • Empowerment –Social, Educational, Economic, Women and Human. • Private Public Partnership (PPP), its advantages and disadvantages.	Constitutional Provisions and Programs for Rural Development	06

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
4	Write report related to particular village (Group of 10 students). Survey, observe and propagate Modern Technology (Rural Housing, Non Conventional Energy, Rural Water Supply and Sanitation, Agricultural allied industries etc.) in Rural Development. Report includes: • Low cost housing. • Rural water supply and sanitation, • Water conservation and Water shed management, • Non-conventional energy. • Computer application and Management Information system, Info – literacy, Global village • Solid waste management.	Technology for Rural Development	06
5	Write report related to particular village (Group of 10 students). Survey issues and challenges in Rural Development programs and suggest Rural – Urban link for social change in rural development and Nation Building. Report includes: • Basic micro-economic theories and concepts, Growth, Income, Employment, Finance. • Rural resources – Land, Forest, Water, Human, Capital and Market. • Rural Economy - Agriculture Reforms, Rural Finance, Rural Urban linkage. • Understanding BUDGET of Central and State Govt. • Corporate Social Responsibilities. • SEZ, Advantages and disadvantages on rural development.	Economical Developments	06
6	Present a report on Rural Development experiences of the same village, challenges, opportunities, suggestions. Presentation includes: • Success stories of rural development in India, Asia and other countries.	Rural Development Success Stories	04
Total			32

Note – The students shall select any one village and perform all practical based on experiences in that village.

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	25	10	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Writing skills, Data collection from internet, Writing references, etc.	05
2	Survey skills, Preparation of questionnaire, Gathering information through interviews, etc.	10
3	Knowledge of rural development schemes, its salient features, its role in rural development, etc.	10
4	Knowledge of modern technology, Tech terms, its need in rural area, rural development through technology, etc.	10
5	Rural urban linkage, sustainable human development, global village, etc.	05
6	Presentation and viva-voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	3	-	-	-	-	-	1	-	3	-	-
2	3	3	-	3	-	-	-	3	3	3	-	-
3	3	3	-	3	-	-	2	3	3	3	-	-
4	3	3	2	3	3	-	3	3	3	3	-	-
5	3	3	2	3	3	2	1	3	3	3	-	-
6	3	3	2	3	1	-	1	-	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Micro Enterprise & Rural Development In India,	Subrata Kumar Ray, Neha Publishers & Distributors.	9788183875752
2.	Rural Development Indian Context,	Expert Panel Of GPH, Publisher: GPH.	9789382688976
3.	Rural Development Planning And Management,	Expert Panel Of GPH, Publisher: GPH	9789382688990
4.	RURAL DEVELOPMENT, Concept and Recent Approaches, ,	A. Thomas William and A.J. Christopher, Edition – 2011.	9788131602652,
5.	Rural Development & Policies	Dr. B.D. Sharma,	9789381385418

6	Empowering Rural Development Through Panchayats.	Dr. H.K. Lal, Publisher: Neha Publishers & Distributors	9788174456250
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❖ **E-REFERENCES:**

- www.un.org/esa/agenda21/natlinfo/countr/israel/ruraldevelopment.pdf , assessed on 5th March 2016
- rural.nic.in/sites/downloads/NewReleases/Greening_RD_Report.pdf , assessed on 5th March 2016
- planningcommission.nic.in/plans/stateplan/sdr_punjab/sdrpun_ch5.pdf, assessed on 5th March 2016
- jica-ri.jica.go.jp/IFIC_and_JBICI-Studies/english/.../pdf/chapter4.pdf. assessed on 5th March 2016
- www.fao.org/3/a-ah885e.pdf, assessed on 5th March 2016
- [yojana.gov.in/CMS/\(S\(y4drc55g1m1qhnd4soqih45\)\)/pdf/.../January.pdf](http://yojana.gov.in/CMS/(S(y4drc55g1m1qhnd4soqih45))/pdf/.../January.pdf), assessed on 5th March 2016
- <https://www.youtube.com/watch?v=LXgyAfnBgWo>, assessed on 5th March 2016
- <https://www.youtube.com/watch?v=jCpEh78M4xE> assessed on 5th March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Not Applicable

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. S.J. Patil	Head of Civil Engineering	Government Polytechnic, Nagpur.
2.	Mr. B. R. Ambade	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
3.	Mr. T. K. Rangari	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
4.	Ms. D. A. Khandare	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
5.	M. R. Shelote	Consultant	M.R. Associates, Nagpur
6.	Dr. R. N. Khapre	Associate Professor	RCOEN, Nagpur
7.	A. J. Fulzele	Assistant Secretary (Tech)	MSBTE, RO, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

LEVEL - II

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/AE/MT/PK/TX
LEVEL NAME : BASIC SCIENCE COURSES
COURSE CODE : CA201E
COURSE TITLE : COMPUTER APPLICATIONS
PREREQUISITE : NIL
TEACHING SCHEME : TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS : 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE : NIL
PR. TEE : 02 HRs (Internal)
PT. : NIL

❖ RATIONALE:

Engineering students should know the basics of handling the computers. This course describes the basics of word processing, table handling, and power point presentations for the understanding of elementary knowledge related to IT applications. It also describes basics of problem solving using C language, for the understanding of elementary knowledge related to logic development. It is very useful course for understanding the higher level knowledge in the field of IT applications and software engineering.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use various formatting tools available in word processor.
2. Handle spread sheets.
3. Prepare presentation.
4. Draw block diagrams, figures.
5. Use LATEX for writing project report
6. Create static website using HTML

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	• Create new document , open existing document and perform various operations on text like Font setting , delete, select, insert, copy- paste, cut- paste, find and replace.	WORD PROCESSING	2
2	• Perform various page setup operations like paragraph setting, page margin, size, orientation, watermark, page borders.		2
3	• Insert and remove Picture/ Image, Tables, Hyperlink, page break, Headers-Footers, bulleted lists in document.		2
4	• Perform Mail merge operation.		2
5	• Open blank /existing worksheet and perform operations like select, delete, insert, copy- paste, cut- paste, find & replace text / data in cell and range of cells. • Perform various formatting operations like, Data Alignment, Wrap text, merge / unmerge cells, change column width, row height, setting page margin, size, orientation, print area.	SPREADSHEET	2
6	• Insert and remove Picture/ Image, Hyperlink, page break, Headers-Footers, in worksheet. Insert and remove cells, rows, columns. Draw various types of graphs / charts.		2
7	• Perform various Functions like sum, average, count, countif, countblank, min, max, upper, lower, len, trim, left, right, mid, date, day, today, month, year, abs, int, exp, floor, sign, sum, sumif, sqrt and formulae like calculating simple interest, compound interest etc. on data in a worksheet.		4
8	• Sort data in ascending and descending order, on one and more than one field. • Apply Filter and obtain desired information.		2
9	• Create new presentation, add /delete slides, insert / delete tables, word Art, header/footer ,slide number, cliparts, images in slide, hyperlink.	PRESENTATION	2
10	• Apply various slide transition methods; apply animation effect, setup slide show, for selected slides.		2
11	• Draw diagrams in a slide, using various available shapes, insert / modify/ delete charts in slide.	PRESENTATION	2
12	• Draw block diagrams, circuit diagrams etc. • Save diagrams in jpg/ TIFF formats • Insert saved diagrams in documents	DRAWING TOOL	4

13	• Open LATEX document • Write simple mathematical equations in LATEX document • Insert figures and tables in in LATEX document • Generate the reports using templates	LATEX	4
14	• Create HTML document by using different tags, elements and attributes (any four) • Create HTML document by using various formatting tags (text level and paragraph level). (any four) • Design webpage using nesting list. (using OL, UL and DL)	HTML	4
15	• Add images, tables and text links in created document. • Insert multimedia in webpage using various techniques		4
16	• Set various attributes of tables. • Set various attributes of images. • Create hyperlink to text, image, table content and email.		4
17	• Create HTML document by using frame and frameset tags (any two)		2
18	• Create HTML document by using frame and frameset tags along with various attributes.		2
19	• Create HTML document by using form and its elements (any two)		2
20	• Create login form and set password.		2
21	• Create static website using all above HTML facilities. (MINI PROJECT)		8
Skill Assessment			4
Total Hrs			64

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Nil

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Activities	20
2	Performance	20
3	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	3	3	-	-	-	3	3	3	-	-
2	3	-	3	3	-	-	-	3	3	3	-	-
3	3	-	3	3	-	-	-	3	3	3	-	-
4	3	-	3	3	-	-	-	3	3	3	-	-
5	3	-	3	3	-	-	-	3	3	3	-	-
6	3	-	3	3	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	World wide web designing with HTML	C. Xavir	13: 9780074639719
2.	HTML5 for Publishers	Sanders Kleinfeld	10/ASIN: B005ISQ7JM
3.	HTML5 for Web Designers	Jeremy Keith	10/ASIN: 0984442502

❖ **E-REFERENCES:**

<http://www.w3schools.org.in>, accessed on 11th April, 2016

30/03/2016 <https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf> accessed on 11th April, 2016

<https://www.latex-tutorial.com/tutorials/> accessed on 11th April, 2016

<http://www1.maths.leeds.ac.uk/LaTeX/TableHelp1.pdf> accessed on 11th April, 2016

http://www.tutorialspoint.com/html/html_frames.htm accessed on 21st April, 2016

showmedo.com/videotutorials/openoffice accessed on 29th April, 2016

www.tutorialsforopenoffice.org accessed on 29th April, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Computer (Dual CORE and above)
2. Network printer.
3. Office Suite.
4. LATEX.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. S.P. Lambhade	Head of Computer Engineering	Government Polytechnic, Nagpur.
2.	Dr. Mrs. A.R. Mahajan	Head of Information Technology	Government Polytechnic, Nagpur.
3.	V.A. Raje	Lecturer in Computer Engineering	Government Polytechnic, Nagpur.
4.	Dr. A.R. Mahajan	Head of Information Technology	Government Polytechnic, Nagpur.
5.	L.D. Vilhekar	Lecturer in Information Technology	Government Polytechnic, Nagpur.
6	Shri. Atul Upadhyay	CEO	Vista Computers , Ram Nagar, Nagpur
7	Shri. N. V. Chaudhari	Asst. Professor (CSE)	DBACEO, Wanadongri, Nagpur
6	Shri. Manoj Jethawa	HOD Computer Science	Shri Datta Meghe Polytechnic, Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/IT/CM /MT/PK/AE/TX
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: PH201E
COURSE TITLE	: ENGINEERING PHYSICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

❖ RATIONALE:

Engineering physics is an essential part of the educational system and of an advanced society, therefore this course essentially required for engineering courses. The different streams of physics provides fundamental facts, principals and laws are very helpful in having better understanding of the other technology courses which contributes to the technological infrastructure and provides trained personnel needed to take advantage of scientific advances and discoveries. Physics is an exciting intellectual adventure that inspires young people and expands the frontiers of our knowledge about Nature.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply the principal and laws of Physics on physically observable things to their respective disciplines.
2. Illustrate broad ideas about different physical phenomena.
3. Apply fundamental physics in various Engineering fields.
4. Select proper measuring instruments on the basis of range and least count to measure the physical quantities.
5. Calibrate different measuring instruments.
6. Handle instruments carefully to avoid any type of devastation.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. General Properties of solids	1. Relate Deformation in bodies by the action of external forces. 2. Identify least count and range of instruments. 3. State hook's law of elasticity. 4. Define different terms related to elasticity. 5. Differentiate accuracy and precision. 6. Describe the types of modules of elasticity. 7. Illustrate the Searle's apparatus. 8. Solve the numerical based on Elasticity.	1.1 Elasticity, Plasticity, Rigidity. Deformation in bodies by the action of external forces, Stress and Strain with their types, Elastic Limit, Hook's Law, yield point, factor of safety, breaking stress, ultimate stress. Applications of elasticity. Types of modulus of Elasticity with relation between them. 1.2 Searle's method to find out Young's modulus of elasticity. Least count and range of instruments: Vernier caliper, outside micrometer screw gauge, Travelling microscope. (Numerical based on above)	06
2. General Properties of liquids	1. Define the terms related with general properties of liquid. 2. State the factors affecting surface tension and viscosity. 3. Select the laws of viscosity to find the coefficient of viscosity of freely falling body. 4. Classify the types of flow of liquid with significance of Reynold's number. 5. Illustrate the phenomenon of Capillarity and angle of contact of liquid and glass. 6. Solve the numerical based on general properties of matter.	2.1 Surface Tension, Factors affecting surface tension, Molecular force, cohesive and adhesive force, Angle of contact with its significance and capillary action (no derivation), Effect of impurity and temperature on surface tension. Application. (Numerical based on above) 2.2 Viscous force, Definition of viscosity, Newton's law of viscosity, Reynolds's number and its significance, critical velocity, streamline flow, turbulent flow, Stoke's law, statement and formula (no derivation), Coefficient of viscosity and S.I. unit. Application. (Numerical based on above)	08
3. Transmission of heat and Gas laws	1. List the modes of transmission of heat. 2. Define the terms related to expansion of solid due to heat. 3. State the laws related to gas and specific heat. 4. Describe Mayor's relation. 5. Apply the adiabatic and isothermal expansion for bulk modulus of elasticity. 6. Solve the numerical related to gas laws and heat.	3.1 Heat: Three modes of transmission of heat- conduction, convention, radiation. Good and bad conductor of heat with examples, Law of thermal conductivity and S.I. units, Coefficient of linear, aerial and cubical expansion, relation between them (no derivation). (Numerical based on above) 3.2 Boyles law, Charle's law, Gay Lussac's law, absolute zero temperature, Kelvin scale of temperature, General gas equation (statement only), two specific heats	10

		of gases, relation between them, Mayer's relation. . Isothermal process and adiabatic process(Numerical based on above)	
4. Wave motion and Acoustics	1. Define different terms related to Acoustics. 2. Reproduce the formula for velocity of sound with end correction. 3. Classify the different types of wave by their characteristics. 4. Recognize sound absorbing textile material. 5. Describe the phenomenon of resonance with examples. 6. Describe the Doppler effect and Sabine's formula. 7. Implement the conditions for good acoustics in auditorium. 8. Solve the numerical related to wave motion and acoustics.	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. forced and free vibration, definition of resonance with example, procedure to find resonance with the help of tuning fork. Formula for velocity of sound with end correction, various factors which depends on it.(Numerical based on above) 4.2Introduction to Doppler Effect and its applications. Echo, Reverberation, Reverberation Time. Absorption coefficient of material, Sabine's formula for reverberation time, Factors affecting the Reverberation of time and acoustics of building. Sound absorbing materials. (Numerical based on above)	14
5. Modern Physics	1. Define the terms related to topics in modern physics. 2. List the properties applications of LASER. 3. State the characteristics of photo electric effect. 4. State the applications related to X-ray, LASER, and photo cell. 5. Implement the photoelectric effect to develop photocell. 6. Illustrate the construction and working of Ruby LASER 7. Describe the production of X-rays. 8. Solve the numerical base on Photo-electricity and X-rays.	5.1 Photon, properties of photons, Planck's hypothesis, Threshold frequency, threshold wavelength and work function, Photoelectric effect with characteristics properties. Principle, Construction and working of Photoelectric cell with applications. Einstein's photoelectric equation. (Numerical based on above) 5.2 Properties of laser, Types of laser, absorption, spontaneous and stimulated emission. Definition of Pumping and its type, Population inversion, Metastable state. Ruby laser: Principle, construction and working. Applications of LASER in Engineering and biomedical Engineering. 5.3Introduction to X-rays, Properties of X-rays, production of X-ray using Coolidge tube. Formula for Minimum wavelength of X-rays, Applications of X-rays in Engineering, medical and scientific field.(Numerical based on above)	18

6. Optical Fiber and Nanotechnology	1. Define the terms related to Optical fiber and nanotechnology. 2. Draw the diagram for inner structure of optical fiber. 3. State the applications of Optical fiber and nanotechnology. 4. Clarify the properties of nanoparticles are different than other particles. 5. Describe the principle of optical fiber. 6. Solve the numerical based on optical fiber.	6.1 Optical fiber, Material of Optical fiber. Structure of optical fiber and its types. Principle of Optical fiber-total internal reflection. Acceptance angle, Numerical aperture. Applications of Optical Fiber.(Numerical problems) 6.2 Definition of nanoscale, nanometer, nanoparticle, nanostructured materials with examples, Application of nanotechnology in Engineering and Technology, medical, cosmetics, environmental, space and defense.	08
Total Hrs.			64



B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Pract-icals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify the various instruments used in Physics laboratory and follow precautionary measures.	General Properties of solids	2
2	Determine least count and range of Vernier Caliper, Outside micrometer screw gauge and calculate its zero error.		2
3	Calculate the diameter of a small spherical body by Outside micrometer screw gauge.		2
4	Measure the outer diameter of a cylindrical body by Vernier Caliper.		2
5	Calculate the value of Young's modulus of elasticity of given wire and identify the type of material from standard value.		2
6	Find rise of liquid in capillary tube and compute surface tension of liquid.	General Properties of liquids	2
7	Compose the relation between terminal velocity and radius of spherical body with different materials passing through the liquid.		2
8	Find the most viscous fluid from given fluids by calculating coefficient of viscosity.		2
9	Analyze the effect of volume on pressure at constant temperature.	Transmission of heat and gas laws	2
10	Calculate mechanical equivalent of heat, J by electrical method.		2
11	Determine inner diameter of resonance tube using Vernier Caliper.	Wave Motion and Acoustics	2
12	Find the velocity of sound with the help of resonance tube. OR Determine the unknown frequency of tuning fork by sonometer.		2
13	Measure the angle of divergence of Laser.	Modern Physics	2
14	Find total internal reflection of light by pin method. OR Calculate the surface area (SA), volume (V) and SA/V of an object and measure dimensions required for it.	Optical Fiber and Nanotechnology	2
Skill Assessment			4
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	General Properties of solids	06(00)	00(04)	00(00)	06(04)
02	General Properties of liquids	02(00)	08(06)	00(00)	10(06)
03	Transmission of heat and gas laws	02(00)	04(04)	06(04)	12(08)
04	Wave Motion and Acoustics	04(04)	04(02)	06(00)	14(06)
05	Modern Physics	02(04)	10(04)	06(00)	18(08)
06	Optical fiber and Nanotechnology	02(02)	08(00)	00(06)	10(08)
	Total	18(10)	34(20)	18(10)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	5	R	2	6	R	2	6	R	2	5/7
	4	U	2																
02	1	R	4	2	U	4	2	U	4	1	U	4	3	U	4				3/5
03	3	U	4	4	R	4	4	U	4	4	R	4	3	A	4				3/5
04	6	U	4	5	U	4	6	U	4	5	R	4	5	U	4				3/5
05	5	A	6	4	A	6	2	U	6										2/3
06	5	U	6	3	A	6	6	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
End Of Course		End Of The Course		Questionnaires				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram/figure, selection of equipment's.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	-	-	-	2	-	-
2	3	-	-	-	-	-	-	-	-	2	-	-
3	3	-	-	-	-	-	-	-	-	2	-	-
4	3	-	2	2	-	-	-	2	-	2	-	-
5	3	-	2	2	-	-	-	2	-	2	-	-
6	3	-	2	2	-	-	-	2	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Modern Physics	B.L.Thereja, S.Chand & Company Ltd 5 th Edition, 2014	13:978-8-12-190163-5
2.	Engineering Physics	V.Rajendran, The McGraw Hill Education Pvt. Ltd, 1 st Edition, 2010	13: 978-0-07-107014-0
3.	Conceptual Physics	P.G.Hewitt, San Francisco Addison Wesley- 10 th Edition, 2006	13: 9780321909107
4.	Engineering Physics	R.K.Gaur And S.L.Gupta, Dhanpatrai Publication New Delhi, 1987	97-8-18-992822-3

❖ **E-REFERENCES:**

<https://www.youtube.com/watch?v=7vT-988yH3M> , assessed on 5th march 2016
https://www.youtube.com/watch?v=XMWcQ4Fn_3I , assessed on 4th march 2016
<https://www.youtube.com/watch?v=6L3Y6UnWe6M> , assessed of 5th march 2016
https://www.youtube.com/watch?v=KjUIKF6_4LI , assessed on 2nd march 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS 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 pattern 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. sonometer teak wood with length 1m.
7. Tuning fork -256, 320, 384, 428, 480, 512 Hz.
8. Boyle's apparatus iron base double steel rod, 25 ml fitted with leveling screw on base
9. Stoke's apparatus with glass tube 50 cm.
10. Stop watch GEM 1/10 sec.
11. Ammeter (DC, 0-5 Amp)
12. Millimeter (DC, 0-1 Amp. G.E. type D 50)
13. Voltmeter (DC, 0-3V)
14. Rheostat single tube of 6.5 cm dia., 30 cm length, 5 Amp, 18 ohm, provided with Bakelite slider with phosphor, bronze contacts.
15. Joule's calorimeter with mass 198 cal/gms.
16. Laser

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	M. K. Malke	I/C Physics Department	Government Polytechnic, Nagpur.
2.	Dr. K. S. Moon	Associate Professor	Dharampeth M P Deo Memorial Science College, Nagpur
3.	Mrs. Farheen Baig	Assistant Professor	Priyadarshini College of Engineering, Nagpur
4.	Mrs. M.B. Mahaley	HOD, Physics Department	SDMP, Nagpur
5.	Dr. S. B. Raut	Lecturer	Government Polytechnic, Nagpur.
6	Mrs. S.B. Adulkar	Lecturer	Government Polytechnic, Nagpur.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/AE/MT/PK
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: CH 201E
COURSE TITLE	: APPLIED CHEMISTRY
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

❖ RATIONALE:

Chemistry is the basic science which is essential to all engineering courses. For an engineer, the usage of equipments and instruments would require knowledge of chemical substances, their composition and properties. 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.

Study of Applied chemistry is essential to mechanical engineering course group. It provides knowledge about the appropriate use of engineering materials, their protection, study of extraction of iron, study of different fuels and their usage and lubrication process in different working conditions of machines. This will be gateway for development of reasoning capacity of students and understanding new technology as well.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use principles and basic laws of chemistry in engineering field.
2. Select and apply knowledge of metal and nonmetallic materials in field of engineering and Technology.
3. Select proper fuel and lubricants on the basis of properties and application.
4. Record readings of experiments.
5. Conclude result of practical on the basis of ultimate stakeholders or society.
6. Safely handle chemicals and equipments which are correlate with safety of others and environmental protection

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Chemical Bonding	1. Define terms related to Atomic structure. 2. State postulates of Bohr's Theory. 3. Draw schematic diagram of atom. 4. State all steps of formation of molecules. 5. Review the filling up orbital by Aufbau principle and Hund's rule.	Atomic Structure: 1.1 Definition of Atom, Fundamental Particles of Atom – their Mass, Charge, Location. 1.2 Postulates of Bohr's Theory 1.3. Definition, Shape of the orbitals & distinction between Orbits & Orbitals. 1.4 Hund's Rule, Filling Up of the Orbitals by Aufbau's Principle (till Atomic no. 30). Valence: 1.5 Definition & types of valence (Electrovalence & Covalence). 1.6 Octet Rule, Duplet Rule. 1.7 Formation of Electrovalent e.g. NaCl, CaCl ₂ , MgO, AlCl ₃ . 1.8 Formation of Covalent Compounds CO ₂ , H ₂ O, NH ₃ , C ₂ H ₂ . 1.9 Distinction between electrovalent & covalent compounds.	10
2. Metallurgy and Alloys	1. Describe the process of extraction of iron from its ore. 2. State different processes of Heat treatment. 3. Select effects of alloying elements on properties of steels. 4. State importance and purposes of heat treatment of steel.	Metallurgy 2.1 Definitions of metallurgy, ores of iron. 2.2 Extraction of pig iron by smelting in Blast furnace with chemical reactions in different zones. Product of Blast furnace 2.3 Composition, properties and applications of pig iron, slag and flue gases. 2.4 Properties and applications of commercial forms of iron-pig iron, cast iron, wrought iron Steels 2.5 Definition of steel. Classification of plain carbon-low carbon, medium carbon, high carbon steel with their properties and application. Alloy steel 2.6 Effect of alloying element C, Ni, CO, V, Mo, W, Cr on properties of steel, 2.7 Composition, properties and application of heat resisting steel, Nicrome, magnetic steel (alnico), 18-8 stainless steel, 18-4-1 high speed steel. Heat treatment of Steels 2.8 Definition and purposes of –Hardening, Tempering, annealing, and Normalizing.	12
3. Non-Metallic Engineering Materials	1. Distinguish between thermo softening and thermosetting plastics. 2. List the properties of Rubber.	Polymers (Plastics, Rubber) 3.1 Definition and types of Plastic, thermo softening and thermosetting plastics. Properties, properties and uses of plastic. 3.2 Formation of Plastic by Addition &	08

	3. State the applications of thermal insulators, Thermocole and Glass wool. 4. Describe applications of Polyethylene & Bakelite plastic	Condensation process (by giving e.g. of Polyethylene & Bakelite plastic Respectively) 3.3Rubber: Types of Rubber. 3.4Natural Rubber: Its Processing, Drawbacks of Natural Rubber, Vulcanization of Rubber with Chemical Reaction. 3.5 Synthetic Rubber: Definition, difference between natural and synthetic rubber, 3.6 Properties of synthetic rubber such as elasticity, tack, abrasion resistant, their definition and related applications. 3.7 Insulating material Definition & Characteristics of Thermal insulators. Preparation, Properties & Applications of Thermocole & glass wool.	
4. Energy	1. State characteristics of a good fuel. 2. State significance of proximate analysis of a fuel. 3. Describe the process fraction distillation of crude petroleum. 4. State significance of Biogas, LPG and CNG. 5. Compare different types of fuel- solid, liquid and gaseous.	Energy 4.1 Definitions of a fuel, calorific value and ignition temperature, 4.2 Characteristics of a good fuel, Classification of fuels with suitable examples, advantages and disadvantages of solid fuels, liquids fuels and gaseous fuels. Classifications of fuel : 4.3 Solid fuels: analysis of solid fuels- Proximate analysis for determination of moisture, volatile matter, ash and fixed carbon, significance of Proximate analysis, 4.4 determination of gross calorific value by using Bomb calorimeter. 4.5 Liquid fuels—Origin, fractional distillation of crude petroleum, boiling range, composition and applications of petroleum fractions obtained. 4.6 Composition, properties applications of- Biodiesel. Gaseous fuels 4.7Composition,properties,applications of Biogas, LPG, CNG	16
5. Lubricants	1. State functions of lubricants 2. Describe the mechanism of lubrication. 3. State characteristics of Lubricants. 4. Select proper lubricant on the basis of different types of machines.	5.1 Definition, Types of Lubricants, Functions of Lubricants. 5.2 Types of lubrication. Fluid film lubrication, Boundary lubrication and Extreme pressure lubrication. 5.3 Characteristics of Lubricants- Viscosity, oiliness ,viscosity Index, oiliness , Volatility, cloud and pour point, Flash and fire point, Neutralization number, emulsification. 5.4 Selection of Lubricant for various types of machines such as I.C engine, steam engine	10

		cylinder Gear system, cutting tools delicate and simple machines, tractors and rollers.	
6. Corrosion	1. State mechanism of atmospheric corrosion and immersed corrosion. 2. Describe different methods of protection of metal from corrosion. 3. Select proper protection method for different types of material from corrosion.	6.1 Definition of corrosion, Types of corrosion, mechanism of Atmospheric or chemical corrosion .Effect of oxide film on atmospheric corrosion. Factor effecting atmospheric corrosion. 6.2 Immersed Corrosion or Electrochemical Corrosion, definition, types and mechanism(Hydrogen evolution and oxygen absorption) 6.3 Factors Affecting Electrochemical Corrosion 6.4 Protection of Metals by Purification of Metals, Alloy Formation, Cathode Protection, 6.5 Controlling the External Conditions 6.6 Application of Protective Coatings like metal coating by - Galvanizing, Tinning, Sherardizing Metal Spraying, Metal Cladding, Cementation or Diffusion Method. 6.7 Application of non metallic coatings: paint- definition, characteristics, constituents of paint and their functions.	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Pract-icals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Explore the chemistry laboratory.	Chemical Bonding	02
2	Determine the percentage of Iron in given steel sample by redox titration. OR Determine the percentage of copper in given alloy sample.	Metallurgy and Alloys	02
3	Find the relation between loss in weight of aluminium strip in acidic and alkaline medium and rate of corrosion.	Corrosion	02
4	Determine the strength of given hydrochloric acid solution by titrating it against sodium hydroxide solution.		02
5	Determine thinner content in oil paint.		02
6	Determine the percentage of moisture content in the given coal sample.	Energy	02
7	Determine the percentage of ash content in the given coal sample by proximate analysis.		02
8	Determine coefficient of viscosity using Ostwald's Viscometer	Lubricants	02
9	Determine acid value of lubricant by KOH OR Determine flash point of lubricant by use of flash point apparatus.		02
10	Prepare Phenol formaldehyde resin used in manufacturing of Bakelite Plastic.	Non-Metallic Engineering Materials	02
11	Analyse basic and Acidic Radicals of known salt solution-1 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	02
12	Analyse basic and Acidic Radicals of known salt solution-2 (Confirmatory Test) using qualitative analysis method.		02
13	Analyse basic and Acidic Radicals of known salt solution-3 (Confirmatory Test) using qualitative analysis method.		02
14	Analyse basic and Acidic Radicals of known salt solution-4 (Confirmatory Test) using qualitative analysis method.		02
Skill Assessment			4
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Chemical Bonding	06(04)	04(04)	00(00)	10(08)
2	Metallurgy and Alloy	02(00)	04(06)	06(00)	12(06)
3	Non-Metallic Engineering Material	06(00)	04(04)	00(00)	10(04)
4	Energy	02(04)	10(02)	06(04)	18(10)
5	Lubricant	02(00)	08(00)	00(00)	10(06)
6	Corrosion	00(02)	04(04)	06(00)	10(06)
	Total	18(10)	34(20)	18(10)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	4	U	2	5/7
	6	R	2																
02	1	R	4	1	U	4	2	U	4	1	R	4	1	U	4				3/5
03	3	R	4	3	U	4	4	U	4	3	U	4	4	R	4				3/5
04	5	U	4	5	U	4	6	U	4	4	A	4	6	U	4				3/5
05	2	A	6	4	A	6	2	U	6										2/3
06	4	U	6	6	A	6	5	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Writing chemical reactions, handling the equipment, writing procedure etc.	10
2	Performance	20
3	Calculation, result, drawing graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	-	-	-	-	-	-
2	3	2	-	-	-	-	-	-	-	-	-	-
3	3	2	-	-	-	-	-	-	-	-	-	-
4	3	-	3	-	-	-	-	3	-	3	-	-
5	3	-	2	-	-	-	-	2	-	2	-	-
6	3	-	1	-	-	2	-	1	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Engineering Chemistry	Jain and Jain , Dhanpat Rai publishing company(P) ltd.16 th Edition reprint 2015	978-93-437-07-3
2	A Text book of Engineering Chemistry	S. S. Dara ,S. Chand Publication,15 th Edition	9788121903592
3	Engineering Chemistry	R. Sivakumar , N. Sivakumar and Tata McGraw-Hill, 10 th Edition	9780745-328896
4	Polytechnic Chemistry	Vedprakash Mehta ,Jain brothers, 6 th Edition	13-9788183600134
5	Industrial Chemistry	B.K.Sharma, Goel Publication, 8 th Edition	8187224002, 9788187224006

❖ **E-REFERENCES:**

http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_fluids-

assessed on 2 Feb. 2016

<http://www.asetute.com.au/corrosion.html>, assessed on 4 Feb. 2016

http://www.sherardizing.com/resources/files/9_Sherardizing_Corrosion.pdf, assessed on 4 Feb. 2016

<http://www.galvanizeit.org/aga/animation>, assessed on 6 Feb. 2016

http://www.ehow.com/list_6725219_different-types-metal-cladding.html, assessed on 8 Feb 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS 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. Muffle furnace(temp. measure up to 1500⁰ c)
9. Oven (temp measure up to 500⁰ c)

❖ **LIST OF EXPERS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

Sr. No	Name	Designation	Institute/Industry
1.	Dr. P.J. Sondawale	I/C chemistry Department	Government Polytechnic, Nagpur
2.	Dr. Mudrika I. Ahmed	Lecturer in chemistry	Government Polytechnic, Nagpur
3.	Dr. M. S. Rathod	Lecturer in chemistry	Government Polytechnic, Nagpur
4.	Dr. S. A. Petkar	Lecturer in chemistry	Government Polytechnic, Nagpur
5.	Mr. S.R. Gaidhar	Lecturer in chemistry	Government Polytechnic, Gadchiroli
6.	Dr. S. Z. Jadhav	Professor in chemistry	Institute of Science, Nagpur
7.	Dr. K. A. Nandekar	Lecturer in chemistry	G.H.Raisoni Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/AU/PK/MT/EE/EC/IT/CM/TX
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: MH201E
COURSE TITLE	: ENGINEERING MATHEMATICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH:04; TU: 01; PR:00 (CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: NIL
PT.	: 01 HR

❖ **RATIONALE:**

The subject is classified under basic sciences and intends to teach students basic facts, concepts and principles of Mathematics as a tool to analyze Engineering problems. Mathematics lay- down the foundation for understanding core Technology subjects.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Develop logical thinking which is useful in comprehending the principles of all other subjects.
2. Use concept of allied angle, compound angle, multiple, and sub multiple angle to solve engineering problems.
3. Use measures of central tendency and measures of dispersion in decision making.
4. Apply matrix method to solve simultaneous equations in two and three variables.
5. Develop intellectual skill by using mathematical concept.
6. Apply laws of logarithm to solve engineering problems.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Logarithm	1. Identify natural and common logarithm 2. Apply laws of logarithm in solving examples	1.1 Definition of logarithm 1.2 Definition of natural & common logarithm 1.3 Laws of logarithm & change of base formula	04
2. Partial fractions	1. Define rational function, proper and improper fraction. 2. Factorize quadratic and cubic polynomial 3. Resolve proper and improper fraction into partial fraction.	2.1 Definition of rational function , proper ,improper fraction and partial fraction 2.2 Resolving proper fraction into partial fraction. 2.2.1 Denominator containing non repeated linear factors 2.2.2 Denominator containing repeated linear factors 2.2.3 Denominator containing irreducible non repeated quadratic factors 2.3 Resolving improper fraction into partial fraction.	06
3. Determinant and Matrix	1. Memorize expansion formula of determinant of order 2 and 3. 2. Find the value of determinant of order 2 and 3. 3. Define various types of matrices. 4. Perform all algebraic operations on matrices. 5. Solve simultaneous equations in two and three variables	3.1 Definition of determinant , order of determinant 3.1.1 Expansion of determinant of order 2 and 3 3.2 Definition of matrix 3.2.1 Types of matrices 3.2.2 Algebra of matrices 3.2.3 Transpose of matrix , ad-joint of matrix and inverse of matrix 3.2.4 Solution of system of linear equations two and three variables by inverse matrix method	14
4. Trigonometry	1. Define allied angle and compound angle. 2. State the formula of multiple angle (2θ and 3θ) sub-multiple angle ($\frac{\theta}{2}$). 3. Verify trigonometric identities. 4. Solve examples using allied angle, compound angle, multiple	4.1 Trigonometric ratios of any angle 4.2 Fundamental identities 4.3 Trigonometric ratios of allied angles 4.4 Trigonometric ratios of compound angles 4.5 Trigonometric ratios of multiple and sub-multiple angles 4.6 Factorization and de-factorization formulae	22

	and sub-multiple angle formula. 5. Solve examples using factorization and de-factorization formula.		
5. Inverse trigonometric functions	1. Define inverse trigonometric functions. 2. Find principle values of inverse trigonometric functions 3. Solve examples of inverse trigonometric functions.	5.1 Definition of inverse trigonometric functions 5.2 Principle values of inverse trigonometric functions 5.3 Relation between inverse trigonometric functions	06
6. Statistics	1. Define mean of data. 2. Memorize formula of mean, combined mean, mean deviation and standard deviation. 3. Find mean and combined mean. 4. Find the range, mean deviation, standard deviation and variance. 5. Find coefficient of variation and compare the consistency	6.1 Measures of central tendency (mean only) 6.2 Combined mean 6.3 Measures of dispersion 6.4 Range, mean deviation, standard deviation 6.5 Variance and coefficient of variation 6.6 Comparison of two sets of observations	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Solve examples using laws of logarithm	Logarithm	01
2	Find partial fraction of proper fraction.	Partial fraction	01
3	Find partial fraction of improper fraction.		01
4	Expand determinant of order 2 and 3.	Determinant and Matrix	01
5	Perform all algebraic operations on matrices		01
6	Find transpose , ad-joint and inverse of matrix		01
7	Solve simultaneous equations in two and three variables		01
8	Verify trigonometric identities.	Trigonometry	01
9	Use allied angle and compound formulae		01
10	Use multiple and sub-multiple angle formulae		01
11	Apply factorization formula to solve examples.		01
12	Apply de-factorization formula to solve examples.		01
13	Find principle values of inverse trigonometric functions and verify formulae	Inverse trigonometric functions	01
14	Find mean of any data and combined mean oftwo sets ofdata.	Statistics	01
15	Find the range, mean deviation, standard deviation and variance.		01
16	Find coefficient of variation and compare the consistency		01
Total Hrs.			16

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Logarithm	00(02)	04(00)	00(00)	04(02)
02	Partial fraction	00(00)	08(06)	00(00)	08(06)
03	Determinant and Matrix	02(00)	08(04)	06(04)	16(08)
04	Trigonometry	06(00)	14(08)	04(04)	24(12)
05	Inverse trigonometric functions	02(00)	04(04)	00(00)	06(04)
06	Statistics	00(02)	12(00)	00(06)	12(08)
	Total	10(04)	50(22)	10(14)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	3	R	2	4	R	2	4	R	2	4	R	2	5	R	2	1	R	2	5/7
	6	R	2																
02	1	U	4	2	U	4	2	U	4	3	U	4	3	A	4				3/5
03	3	U	4	3	U	4	4	U	4	4	U	4	4	A	4				3/5
04	4	U	4	5	U	4	4	A	4	5	U	4	4	U	4				3/5
05	6	U	6	4	U	6	2	U	6										2/3
06	6	U	6	3	A	6	6	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	--	--	--	--
				TOTAL	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ SCHEME OF PRACTICAL EVALUATION:

S.N.	Description	Max. Marks
	NIL	

❖ MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	3	2	-	-	-	2	3	-	3	-	-
2	3	3	2	3	-	-	2	3	-	3	-	-
3	3	3	2	3	-	-	2	3	-	3	-	-
4	3	3	2	3	-	-	2	3	-	3	-	-
5	3	3	2	-	-	-	2	3	-	3	-	-
6	3	3	2	3	-	-	2	3	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ REFERENCE & TEXT BOOKS:

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Higher Algebra	Hall & Knight, Publisher: Arihant, 5 th Edition 2015	9352030605
2	Plane Trigonometry	S L Loney, Publisher: Arihant, 5 th Edition 2015	9352030540
3.	Basic Statistics	B L Agarwal, Publisher: Anshan	1848290675
4.	Engineering Mathematics	S.S .Shastry, Prentice Hall Of India, 4 th Edition 2008	978-81-203-3616-2
5.	Fundamental of Statistics	S C Gupta, Himalaya Publishing House, 7 th Edition 2015	9789350517697

❖ E-REFERENCES:

<https://www.khanacademy.org/math/algebra>, assessed on March 3, 2016

<https://www.khanacademy.org/math/trigonometry>, assessed on March 3, 2016

<https://www.youtube.com/watch?v=BiLIcCtXmm0>, assessed on March 3, 2016

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. S.M. Sayyed	I/C Mathematics Dept.	Govt. Polytechnic Nagpur
2.	Mr. P.T. Khobragade	Lecturer	Govt. Polytechnic Nagpur
3.	Mr. G.R. Dewalkar	Lecturer	Govt. Polytechnic Nagpur
4.	Dr. K. C. Deshmukh	Professor	R. T. M. Nagpur University
5.	Dr. P. B. Bahatkar	Professor	Y. C. C. E. Nagpur
6	Mr. Nasir Khan	Lecturer	Anjuman Polytechnic Nagpur

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/AU/PK/MT
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: MH202E
COURSE TITLE	: APPLIED MATHEMATICS
PREREQUISITE	: MH201E
TEACHING SCHEME	: TH: 04 ; TU:01; PR:00 (CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR.)
TH. TEE EXAM.	: 03 HRs
PR. TEE EXAM	: NIL
PT. EXAM	: 01 HR

❖ **RATIONALE:**

Mathematics is the backbone of Technical courses, Understanding of engineering concepts require logical approach and thinking. The course is extension of Engineering Mathematics of first semester and stepping 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 subjects.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply mathematical term, concept, principles and different methods for studying engineering subjects.
2. Apply mathematical methods to solve technical problems.
3. Execute management plans with precision.
4. Use mathematical techniques necessary for daily practical problems.
5. Apply concept of extrema in finding maximum profit of production and minimum cost or material needed for production of an article.
6. Apply various numerical method to solve algebraic and simultaneous equations.

❖ COURSE DETAILS:

A. THEORY:

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Functions and Limits	1. Identify various types of functions. 2. Define odd and even function. 3. Find value of any given function. 4. Find limits for all different functions.	1.1 Definition of function, value of a function. 1.2 Types of functions. 1.3 Concept of limit. 1.4 Algebra of limits. 1.5 Limits of algebraic functions. 1.6 Limits of trigonometric functions. 1.7 Limits of exponential & logarithmic functions.	10
2. Derivatives and Applications of derivative	1. State limit definition of derivative. 2. Perform all algebraic operations on derivatives. 3. Find slope, Equation of tangent and normal line of the given curve. 4. Solve examples of maxima and minima.	2.1 Definition of derivative, Notations. 2.2 Derivative of standard functions. 2.3 Rules for differentiation (without proof) 2.4 Derivative of composite functions. 2.5 Derivative of inverse trigonometric functions. 2.6 Derivative of implicit functions. 2.7 Logarithmic differentiation. 2.8 Derivative of parametric functions. 2.9 Second order differentiation. 2.10 Applications: Equation of tangent and normal; Maxima and minima.	16
3. Integration, Definite integration and Applications	1. State Integration by parts theorem. 2. Integrate function using different method. 3. Solve examples of definite integral using properties. 4. Find area using integration method.	3.1 Definition of integration as anti-derivative. 3.2 Integration of standard functions. 3.3 Rules for integration. 3.4 Integration by substitution. 3.5 Integration of rational functions. 3.6 Integration by trigonometric transformation. 3.7 Integration by parts. 3.8 Integration by partial fraction. 3.9 Definition of definite integral. 3.10 Properties of definite integral. 3.11 Applications: Area under the curve, Area bounded by two curves.	16
4. Differential equations	1. State order and degree of D.E. 2. Solve differential equations of first order and first degree. 3. Solve different engineering problems using differential equations.	4.1 Definition of differential equation. 4.2 Order and degree of differential equation. 4.3 Methods of solving differential equations of first order and first degree. 4.4 Variable separable method, reducible to variable separable. 4.5 Homogenous differential equation, exact differential equation. 4.6 Linear and Bernoulli equations.	08

5. Numerical methods	1. Identify the interval of root of algebraic equation. 2. Find the approximate root of algebraic equation. 3. Solve the system of simultaneous equations containing 3 unknowns	5.1 Solution of algebraic equation. 5.1.1 Bisection method. 5.1.2 Regula-Falsi method. 5.1.3 Newton-Raphson method. 5.2 Solution of Simultaneous equations containing 3 unknowns. 5.2.1 Gauss elimination method. 5.2.2 Iterative methods: Gauss-Seidal & Jacobi's method.	14
Total Hrs.			64

B LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Find value of any given function.	1. Functions and Limits	01
2	Find limits algebraic functions.		01
3	Find limits trigonometric, exponential functions.		01
4	Solve examples on derivative using algebraic operations.	2. Derivatives and Applications of derivative	01
5	To find dy/dx of implicit functions.		01
6	To find dy/dx of parametric functions and inverse inverse trigonometric functions.		01
7	Find equation of tangent and normal and solve maxima and minima problems.		01
8	Solve examples using rules of integration and substitution method	3. Integration, Definite integration and Applications	01
9	Solve examples using integration by parts and partial method		01
10	Solve examples using integration by parts and partial fraction method.		01
11	Evaluate definite integral using properties.		01
12	Find area using integration		
13	Solve D.E. using variable separable method and reducible to variable separable.	4. Differential equations	01
14	Solve homogenous, linear and Bernoulli D.E.		01
15	Find the approximate root of algebraic equation.	5. Numerical methods	01
16	Solve the system of simultaneous equations		01
Total Hrs.			16

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Functions and Limits	04(00)	08(08)	00(00)	12(08)
02	Derivatives and Applications of derivative	04(00)	08(04)	06(06)	18(10)
03	Integration, Definite integration and Applications	02(00)	08(08)	06(00)	16(08)
04	Differential equations	00(04)	08(00)	00(00)	08(04)
05	Numerical methods	04(00)	12(04)	00(06)	16(10)
	Total	14(04)	44(24)	12 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	2	R	2	3	R	2	4	R	2	5/7
	4	R	2																
02	1	U	4	1	U	4	2	U	4	1	U	4	1	U	4				3/5
03	2	U	4	3	U	4	3	U	4	2	U	4	3	U	4				3/5
04	4	U	4	4	U	4	5	R	4	3	U	4	5	U	4				3/5
05	2	A	6	3	A	6	2	A	6										2/3
06	5	U	6	5	U	6	5	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	--	--	--	--
				TOTAL	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
NIL		

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	3	2	-	-	-	2	3	-	3	-	-
2	3	3	2	3	-	-	2	3	-	3	-	-
3	3	3	2	3	-	-	2	3	-	3	-	-
4	3	3	2	3	-	-	2	3	-	3	-	-
5	3	3	2	-	-	-	2	3	-	3	-	-
6	3	3	2	3	-	-	2	3	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Engineering Mathematics-1	P N Wartikar, Pune Vidyarthi Griha Prakashan	4567155742
2.	Calculus of one variable	IA Maron, Publisher: Arihant, 5 th edition 2015	9352030559
3.	Engineering Mathematics	S.S .Shastri, Prentice Hall Of India, 4 th edition 2008	9788120336162
4.	Engineering Mathematics	D.T.Gaikawad, S Chand Publication, 1 st edition 2010	8121933560
5.	Higher Engineering Mathematics	B S Grewal, Publisher: S Chand, 43 rd edition 2014	9788174091955

❖ **E-REFERENCES:**

http://www-math.mit.edu/~djg/calculus_beginners/, assessed on March 3, 2016

<https://en.wikibooks.org/wiki/Calculus>, assessed on March 3, 2016

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. M. SAYYED	I/C HOD, MATHS DEPTT.	GOVT. POLYTECHNIC NAGPUR
2.	Mr. T. KHOBRAGADE	LECTURER	GOVT. POLYTECHNIC NAGPUR
3.	Mr. R. DEWALKAR	LECTURER	GOVT. POLYTECHNIC NAGPUR
4.	Dr. K. C. DESHMUKH	PROFESSOR	R. T. M. NAGPUR UNIVERSITY
5.	Dr. P. B. BAHATKAR	PROFESSOR	Y. C. C. E. NAGPUR
6	Mr. NASIR KHAN	LECTURER	ANJUMAN POLYTECHNIC NAGPUR

(Member Secretary PBOS)



(Chairman PBOS)

LEVEL - III

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/CE/PK
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: ME301E
COURSE TITLE	: ENGINEERING GRAPHICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 02; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 04 HRs
PR. TEE	: NIL
PT. EXAM	: 02 HRs

❖ RATIONALE:

Engineering graphics is the language of engineers. It describes the fundamentals, facts, concepts, principles and techniques of Engineering Graphics. The course illustrates techniques of drawing in an engineering field. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. 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.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.
2. Apply the technique of geometrical figure. scale, loci of points for further drawing.
3. Relate the views of an object for drawing orthographic and isometric projections.
4. Visualize three dimensional objects and draw isometric projections.
5. Draw orthographic views , isometric views and freehand sketches
6. Apply knowledge of projections of points and solve the problems on projection of straight lines

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Principles of drawing	1. Use drawing instruments. 2. Use IS SP-46 3. Loci of points from given data. 4. Redraw the given drawing.	1.1 Use of different drawing instruments and equipment 1.2 Types of letters and numbers (single stroke vertical and inclined letters and numbers only) 1.3 Conventions of lines, Dimensioning technique as per IS SP -46 1.4 Scales (reduced, enlarged and full size)- Plain scale, diagonal scale, 1.5 Redrawing 1.6 Loci of points	05
2. Engineering curves.	1. Draw conic sections. 2. Draw involute, cycloid and know their applications. 3. Draw helix , spiral from given data.	2.1 To draw an ellipse by: i) Directrix - focus method ii) Arcs of circles method iii) Rectangle method iv) Concentric circles method 2.2 To draw parabola by i) Directrix - focus method ii) Rectangle method 2.3 To draw hyperbola by i) Directrix – focus method ii) Passing through a given point with reference to given asymptotes iii) Transverse axis focus method 2.4 To draw involute of circle and polygon of maximum six sides 2.5 To draw cycloid, epi-cycloid and hypo-cycloid 2.6 To draw Archimedean spiral & Helix	08
3. Orthographic projections.	1. Visualize, interpret and draw orthographic views from given pictorial views. 2. Use of IS SP-46 for dimensioning technique.	3.1 Introduction to orthographic projections 3.2 First angle and Third angle method of projections 3.3 Conversion of simple pictorial views into orthographic views and dimensioning techniques as per IS SP-46	06
4. Isometric projections	1. Visualize, interpret and draw Isometric views/projections from given orthographic views	4.1 Isometric scales 4.2 Isometric views/projections of simple & cylindrical object (plane surfaces, slanting surfaces, and Rectangular, V, Trapezoidal slots)	06
5. Projection of straight lines	1. Locate the projection of points 2. Draw projection of lines.	5.1 Projections of straight lines inclined to one reference plane and parallel to the other – limited to both ends in first quadrant.	03

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
6. Free hand sketches	1. Sketch proportionate freehand sketches of given machine elements 2. Select proper fasteners and foundation bolts	6.1 Types of threads – Vee and square threads, left hand and right hand threads 6.2 Bolts – square and hexagonal bolts, eye bolt 6.3 Types of nuts – square, hexagonal, wing, capstan, cap, flanged, ring and dome nut 6.4 Locking arrangement – lock or check nut, split pin, slotted nut, castle nut, swan nut and grooved nut 6.5 Foundation bolts- Eye foundation bolt, Rag foundation bolt and Lewis foundation bolt 6.6 Riveted joints – Types of rivets, Single/double riveted Lap and Butt joints	04
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw types of lines, lettering, numbers on sketch book and one problem each of scales, loci of points & two problems of redraw. (01 Sheet)	1.Principles of drawing	08
2	Draw four Engineering Curves, one from topic 2.1, one from topic 2.2, 2.3, one from topic 2.4, 2.5 & one from topic 2.6 of chapter 2 (01 Sheet)	2.Engineering Curves	12
3	Draw one problem using first angle method of projection and another using third angle method of projection (01 Sheet)	3 Orthographic Projections	12
4	Draw one problem with plane surfaces & other with cylindrical, slot, slanting surfaces (using natural scale and isometric scale) (01 Sheet)	4. Isometric Projections	12
5	Draw four problems by using first angle method of projection (01 Sheet)	5. Projections of Straight Lines	08
6	Draw Free Hand Sketches – any ten sketches covering all the topics under chapter 6 (01 Sheet)	6. Free Hand Sketches	12
Total Hrs.			64

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Principles of drawing	10(05)	00(00)	00(00)	10(05)
02	Engineering Curves	00(00)	12(06)	00(00)	12(06)
03	Orthographic Projections	00(00)	12(00)	00(12)	12(12)
04	Isometric Projections	00(00)	00(12)	12(00)	12(12)
05	Projections of Straight Lines	00(00)	12(06)	00(00)	12(06)
06	Free Hand Sketches	00(00)	12(08)	00(00)	12(08)
	Total	10(05)	48(32)	12(12)	70 (49)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	5	1	R	5	1	R	5	-	-	-	-	-	-	-	-	-	2/3
02	2	U	6	2	U	6	2	U	6	-	-	-	-	-	-	-	-	-	2/3
03	3	U	12	3	A	12	-	-	-	-	-	-	-	-	-	-	-	-	1/2
04	4	A	12	4	U	12	-	-	-	-	-	-	-	-	-	-	-	-	1/2
05	5	U	6	5	U	6	5	U	6	-	-	-	-	-	-	-	-	-	2/3
06	6	U	4	6	U	4	6	U	4	6	U	4	6	U	4	-	-	-	3/5

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Drawing Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Sketch Book	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Drawing Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Drawing sheet, Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Drawing portfolio		Continuous	05	--	Drawing portfolio	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
Nil		

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:****For Mechanical Engineering:**

Course Outcomes	Program Outcomes (POs)										PSO	PSO
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	3	–	–	–	–	3	3	–	3	–	–
2	3	3	3	3	–	–	3	3	3	3	–	–
3	3	3	3	3	–	–	3	3	3	3	–	–
4	3	3	3	3	–	–	–	3	–	3	3	–
5	3	3	3	3	–	–	–	3	3	3	3	–
6	3	3	3	3	–	–	–	3	3	3	3	–

For Other Programs:

Course Outcomes	Program Outcomes (POs)										PSO	PSO
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	3	–	–	–	–	3	3	–	3	–	–
2	3	3	3	3	–	–	3	3	3	3	–	–
3	3	3	3	3	–	–	3	3	3	3	–	–
4	3	3	3	3	–	–	–	3	–	3	–	–
5	3	3	3	3	–	–	–	3	3	3	–	–
6	3	3	3	3	–	–	–	3	3	3	–	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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	81-7061-091-2
2.	Engineering Drawing	N.D.Bhatt, Charotar Publishing house 2010	978-93-80358-17-8
3.	Machine Drawing	N.D.Bhatt & V. M Panchal, Charotar Publishing house 2010	978-93-80358-11-6
4	Engineering Drawing	D.A.Jolhe, Tata McGrawHill Edu.2010	978-0-07-064837-1
5.	Engineering Drawing	R. K. Dhawan , S. Chand&co.	81-219-1431-0
6	Engineering Drawing	P. J Shaha, S.Chand&co.2008	81-219-2964-4

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=TJ4jGyD-WCw>, assessed on 25th March 2016
- https://www.youtube.com/watch?v=dmt6_n7Sgcg, assessed on 25th March 2016
- https://www.youtube.com/watch?v=_MQScnLXL0M, assessed on 26th March 2016
- <https://www.youtube.com/watch?v=3WXPanCq9LI>, assessed on 26th March 2016
- <https://www.youtube.com/watch?v=fvjk7PlxAuo>, assessed on 27th March 2016
- <http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf> , assessed on 27th March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 1) Drawing Board with drawing instruments
- 2) Minidrafter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	O. V. Sarode	I/C, Head of Mechanical Engineering	Government Polytechnic, Nagpur.
2.	M.G. Thote	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	G.H Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/AE/PK/MT/TX
LEVEL NAME : ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE : WS301E
COURSE TITLE : WORKSHOP PRACTICE
PREREQUISITE : NIL
TEACHING SCHEME : TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS : 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE : Nil
PR. TEE EXAM : Nil
PT. EXAM : Nil

❖ RATIONALE:

Workshop Practice is an engineering science course. The knowledge of this course is essential for technician industry to perform his/her duties. Working in workshop develops the attitude of groups working and safety awareness. This course provides industrial environment in the educational institute.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Adapt safety precautions in workshop
2. Read and interpret job drawing
3. Use hand tools for various operations
4. Apply basic techniques in manufacturing processes
5. Operate different equipments/machineries used in basic shops
6. Perform jobs according to drawing

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Observe the demonstration of hand tools, machine Tools and equipments used in Carpentry Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Carpentry	2
2.	Prepare utility job involving related carpentry operations. (Job to be prepared by group of 2 to 4 students depending on volume of work)		8
3.	Observe the demonstration of hand tools, machine Tools and equipments used in Welding Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Welding	2
4.	Prepare utility job involving related Welding operations. (Job to be prepared by group of 2 to 4 students depending on volume of work)		8
5.	Observe the demonstration of hand tools, machine Tools and equipments used in Fitting Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Fitting	2
6.	Prepare One individual job involving related Fitting operations.		8
7.	Observe the demonstration of hand tools, machine Tools and equipments used in Smithy Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Smithy	2
8.	Prepare One individual job involving related Smithy operations.		8
9.	Observe the demonstration of hand tools, machine Tools and equipments used in Plumbing Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Plumbing	2
10.	Prepare One individual job involving related Plumbing operations.		8
11.	Observe the demonstration of hand tools, machine Tools and equipments used in Sheet Metal Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Sheet Metal	2
12.	Prepare utility job involving related Sheet Metal Shop operations. (Job to be prepared by group of 2 to 4 students depending on volume of work)		8
Skill Assessment			4
Total Hrs.			64

Note: Jobs should be Programme specific.

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Nil

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Jobs, Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Record		Continuous	10	--	Journals	1, 2, 3, 4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF JOB EVALUATION:**

S.N.	Description	Max. Marks
1	Job Drawing	5
2	Handling Tools, machineries and its operations	10
3	Dimension Accuracy	20
4	Overall finishing of Job	5
Total		40

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:****For Mechanical Engineering:**

Course Outcomes (COs)	Program Outcomes (POs)										PSO	PSO
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	3	3	-	-	3	3	-	3	3	-
2	3	-	3	3	-	-	-	3	3	3	3	-
3	3	-	3	3	-	-	-	3	3	3	3	-
4	3	-	3	3	-	-	-	3	-	3	3	-
5	3	-	3	3	-	-	3	3	-	3	3	-
6	3	-	3	3	-	-	3	3	3	3	3	-

For Other Programs:

Course Outcomes (COs)	Program Outcomes (POs)										PSO	PSO
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	3	3	-	-	3	3	-	3	-	-
2	3	-	3	3	-	-	-	3	3	3	-	-
3	3	-	3	3	-	-	-	3	3	3	-	-
4	3	-	3	3	-	-	-	3	-	3	-	-
5	3	-	3	3	-	-	3	3	-	3	-	-
6	3	-	3	3	-	-	3	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	A Course in Workshop Technology	B.S. Raghuwanshi; Dhanpat Rai sons, New Delhi ; 2006, 2011	10-0000017108
2.	Elements of Workshop Technology	Hajra; Choudhary; Media Promoters & Publishers Mumbai, 2009	10-8185099146
3.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta J.K., R.S. Khurmi S.Chand & Co. New Delhi	81-219-3092-8
4.	Workshop Practice Manual For Engineering Diploma & ITI Students	R K Hegde, Sapna Book House, 2012	13: 9798128005830

❖ **E-REFERENCES:**

<http://books.google.co.in/books/isbn=9380026757> , assessed on 17th March 2016

<http://www.asnu.com.au/profile/our-process.aspx> , assessed on 17th March 2016

<https://www.youtube.com/watch?v=swnEQ17cQW>, assessed on 17th March 2016

<https://www.youtube.com/watch?v=c-FN4M77qyA>, assessed on 17th March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Welding Transformer (Air Cooled) Single Phase
2. Welding Transformer (Oil Cooled) Three Phase
3. Gas Welding Set
4. Bench Drilling Machine
5. Hydraulic Power Saw Machine
6. Bench Grinder
7. Bench Vise
8. Wood Turning Lathe Machine
9. Circular Saw Machine
10. Portable Wood Cutting Machine
11. Portable Drilling Machine
12. Carpentry Vice
13. Pipe Bending Machine
14. Pipe Vice
15. Pipe Cutter
16. Black smith Hearth
17. Anvil
18. Swage Block
19. Sheet Bending Machine
20. Sheet Cutting Machine
21. Brazing Equipment
22. All Hand Tools and Measuring Tools use in Carpentry Shop, Fitting Shop, Welding Shop, Plumbing Shop, Smithy Shop and Sheet Metal Shop,

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	D. C. Satadeve	Workshop Superintendant	Government Polytechnic, Nagpur.
2.	Dr. S. W. Rajurkar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
4.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
5.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/PK/MT
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: AM301E
COURSE TITLE	: ENGINEERING MECHANICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 03; TU: 01; PR: 02
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

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 center 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 etc. It helps in forming base for understanding all the courses, which are related to engineering mechanics.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply concept of engineering mechanics in engineering field.
2. Analyze effect of force, friction, centroid and centre of gravity.
3. Solve problems related to force, equilibrium of forces, friction, centre of gravity and simple lifting machines.
4. Prove simple laws of equilibrium of forces.
5. Compute efficiency of different machines.
6. Draw the graphs between load and efforts, load and efficiency.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Introduction of Engineering Mechanics	1.Define terms related to Engineering Mechanics 2. State the units of different scalar and vector quantity.	1.1Definition of engineering mechanics, necessity and Classification of engineering mechanics. 1.2 Definitions: Space, time, particle, body, rigid body, mass, weight, scalar and vector quantity. 1.3Units of measurement (SI units): Fundamental units and derived units.	02
2.Simple lifting Machine	1. Define terms related to simple lifting Machine 2.Describe different types of simple lifting machine 3.State velocity ratio of machines 4. Solve problem related to simple lifting machine	2.1Concept of simple lifting machine, uses of machine, definition of load, effort, mechanical advantage, velocity ratio, efficiency of Machines, reversible and non-reversible machines.. 2.2Ideal machine, friction in machine, law of machine, maximum Mechanical advantage and efficiency. 2.3Velocity 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	08
3.Forces	1.Define Terms Related to Force 2. Define terms related to moments 3. Define terms related to graphic statics 4. State Principal of Transmissibility of Force 5. State Law of parallelogram of forces 6. Describe Resolution & Composition of forces 7. Solve problems on forces.	3.1 Concept of force, definition of force, unit of force, effects of force, Characteristics of force. 3.2System of forces. Principle of transmissibility of force. 3.3 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 3.4 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 moments and its applications 3.5 Introduction to graphic statics, graphical representation of force, Bow's notation, Space diagram, force diagram, polar diagram & funicular polygon.	12

4. Equilibrium	1. Define terms related to Equilibrium 2. State analytical conditions of equilibrium. 2. State Lami's theorem 3. Define terms related to Beam 4. Solve Problems related to Lami's theorem and beam reaction.	4.1 Definition of equilibrium, analytical conditions of equilibrium, free body diagram 4.2 Lami's Theorem: limitations and its applications. (Simple problems, no problems on spheres put in container). 4.3 Equilibrium of concurrent, non-concurrent and parallel forces. Definition of Beam, span, types of beams, types of supports, types of loading: point load and UDL. Analytical method to calculate reactions at support for point load and UDL on simply supported and overhanging beams	10
5. Centroid & Centre of gravity	1. Define centroid and center of gravity 2. State centroids of plain regular figures. 3. Locate centroid of two different geometric areas 4. Solve problems related to compound figures. 5. State the centre of gravity solid bodies 6. Locate c.g of two different solid bodies 7. Solve problems related to compound figures	5.1 Definition of centroid and centre of gravity, difference between centroid and centre of gravity. Locating centroids of regular figures such as triangle, rectangle, circle, semi circle, quarter circle. (No Derivations). 5.2 Locating centroid of compound figures, having combination of two different geometric areas only. 5.3 Centre of gravity of solid bodies like cylinder, cone, sphere and hemisphere. 5.4 Locating centre of gravity of compound bodies having combination of only two different geometric shapes	08
6. Friction	1. Define terms related to friction 2. State laws of friction 3. Apply concept of friction 4. Solve problems related to friction	6.1 Concept of 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. 6.2 Equilibrium of bodies on level surface subjected to force parallel and inclined to plane & inclined plane subjected to force parallel to the plane. (No ladder friction).	08
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Find the M.A., V.R., Efficiency of and law of machine for simple /Differential Axle and Wheel	Simple lifting Machine	2
2	Find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack		2
3	Find the M.A., V.R., Efficiency and law of machine for Two Sheave Or three sheave Pulley Block		2
4	Find the M.A., V.R., Efficiency and law of machine for Single purchase Crab Or Double purchase Crab		2
5	Find the M.A., V.R., Efficiency and law of machine for Worm and Worm Wheel		2
6	Find unknown force using law of polygon of forces.	Forces	2
7	Find forces in the members of jib crane by using triangle law of forces.		2
8	Determine resultant of co-planer concurrent forces by graphical method. (Any two problems)		4
9	Determine resultant of co-planer non Concurrent Forces by graphical method. (Any two problems)		4
10	Find angle between three concurrent forces using Lami's Theorem.	Equilibrium	2
11	Find equilibrium of parallel forces using beam reaction apparatus.		2
12	Determine beam reaction for Vertical Point Load and UDL. (Any two problems)		2
13	Compare co-efficient of Friction between different surfaces such as Wood and wood, Wood and glass, Wood and metal.	Friction	2
Skill Assessment			2
Total Hrs.			32
Tutorials			
1	Forces, Equilibrium, simple lifting machine		08
2	Friction, Centroid and centre of gravity		08
Total Hrs.			16

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction	04(02)	00(00)	00(00)	04(02)
02	Simple Lifting Machine	02(00)	08(04)	00(04)	10(08)
03	Forces	02(00)	12(04)	06(06)	18(10)
04	Equilibrium	02(00)	08(00)	00(06)	10(06)
05	Centroid And Centre Of Gravity	00(00)	04(04)	06(00)	10(06)
06	Friction	00(02)	04(08)	12(00)	16(06)
	Total	10(04)	36(20)	24 (16)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	3	R	2	4	R	2	1	R	2	5/7
	6	R	2																
02	2	U	4	2	U	4	4	U	4	2	U	4	2	A	4				3/5
03	3	U	4	3	U	4	3	U	4	3	U	4	5	U	4				3/5
04	4	U	4	5	U	4	6	U	4	6	U	4	6	U	4				3/5
05	3	A	6	5	A	6	3	A	6										2/3
06	6	A	6	6	A	6	4	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing figure of simple lifting machine and force diagram, selection of equipment's. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	PSO 1	PSO 2
1	3	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-
4	3	-	3	3	-	-	3	3	-	-	-	-
5	3	-	3	3	-	-	3	3	-	-	-	-
6	3	-	3	3	-	-	3	3	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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 13:978-9381595558
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
5.	Static and Straight of Materials	U.C. Zindal Asian Book Pvt. Ltd New Delhi, 2008	10:8184120737 13:9788184120730

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=-JG9IEqRzQ4>, assessed on 28th March 2016
- <https://www.youtube.com/watch?v=4V1hh6sGkrI>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=EcPGKLUe04I>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=ndT35aqDfAQ>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=W9UDs-kSR0g>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=kuAfu0fZOLw>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=PO5EL9TB-v4>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=Bx-mMA6k8u4>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=9XtGJXVnQxk>, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=k37FJHbSQA8>, assessed on 30th March 2016
- https://www.youtube.com/watch?v=6_D6jjQcAFU, assessed on 30th March 2016
- <https://www.youtube.com/watch?v=AOkeQMMsSrc>, assessed on 30th March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- | | |
|---|----|
| 1. simple /Differential Axle and Wheel | 01 |
| 2. Simple Screw Jack | 01 |
| 3. Two Sheave Or three sheave Pulley Block | 01 |
| 4. Single purchase Crab Or Double purchase Crab | 01 |
| 5. Worm and Worm Wheel | 01 |
| 6. Force table apparatus for law of polygon of forces. | 01 |
| 7. Jib crane by using triangle law of forces. | 01 |
| 8. Lami's Theorem. Force table apparatus | 01 |
| 9. Co-efficient of Friction between different surfaces ,
such as Wood and wood, Wood and glass,
Wood and metal. | 01 |

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Y. K. Chandarana	HOD, Applied Mechanics	Govt. Polytechnic, Nagpur
2.	H. S. Chepey	HOD, Civil Engineering	A.S. T. S., Wardha
3.	A. P. Waghmare	Lecturer in Applied Mechanics	Govt. Polytechnic, Nagpur
4.	R. D. Mendhe	Lecturer in Applied Mechanics	Govt. Polytechnic, Amravati
5.	R. N. Nibudey	Lecturer in Applied Mechanics	Govt. Polytechnic, Gondia
6.	M. R. Shelote	Consultant	M.R. Associates, Nagpur
7.	Dr. R. N. Khapre	Associate Professor	RCOEN, Nagpur
8.	A. J. Fulzele	Assistant Secretary (Tech)	MSBTE, RO, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME, PK
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: EE304E
COURSE TITLE	: ELEMENTS OF ELECTRICAL TECHNOLOGY
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

❖ RATIONALE:

Mechanical engineering students should know the facts, concepts, principles and procedures in electrical engineering. This course describes the basic facts, concepts & principles for understanding the basic elementary knowledge related to electrical area. It is very useful course for understanding the basic knowledge of electrical engineering.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Interpret electrical circuit diagram & wiring layout diagrams.
2. Use principles and basic laws in electrical engineering.
3. Identify different parts of various machines.
4. Connect electrical measuring instruments in circuit.
5. Record the readings of various electrical meters.
6. Use different machines for different applications.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Electrical Safety	1. Recall electrical safety rules. 2. Remove the electrocuted person from live conductor 3. Interpret electrical safety signs and symbols 4. Carry out different methods of artificial respiration on electrocuted person 5. Use fire-fighting equipment on different types of fires. 6. Classify various types of earthing. 7. State the need of earthing.	1.1 Electrical Safety, Causes of accidents, General safety rules, Concept of electrical shock, Effect of electric shock, Method of removing electrocuted person, Safety signs and symbols. 1.2 Artificial respiration-Schaefer's method, Silvestre's method, mouth to mouth respiration. 1.3 First Aid 1.4 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B,C, D, Fire fighting equipments, fire extinguishers, and their types . 1.5 Earthing-Necessity of earthing, methods of reducing earth resistance.	06
2. Fundamentals of Electricity	1. Define the various electrical parameters 2. Select the different types of materials for particular applications. 3. State various laws and its applications. 4. Calculate the temperature coefficient of resistance 5. Draw line diagram of power system 6. Describe concept of DC voltage & current. 7. Connect number of resistances in series & parallel.	2.1 Concept of electric charge, current, voltage drop, EMF, potential difference, Direction of current and their SI units. 2.2 Resistance, unit of resistance, Law of resistance (Factors affecting resistance), Effect of temperature on resistance, temperature coefficient of resistance, Ohms law ,Resistance in series, properties of series circuit, voltage distribution in series circuit, equivalent resistance of series circuit, Applications of series circuits, Resistance in parallel, properties of parallel circuit, current distribution in parallel circuit, equivalent resistance of parallel circuit, Applications of parallel circuits, Series-parallel combination, Equivalent resistance of series-parallel combination (Numerical problems based on 2.2) 2.3 Kirchhoff's current and voltage law(no numericals) 2.4 Work, power, energy and their SI units, Joule's law, Relation between H.P and watts, Kwh and Kcal, cost of electrical energy. (Numerical problems based on 2.4) 2.5 Concept of generation, transmission and distribution of electrical power, line diagram of AC power flow in supply systems, voltage levels at various stages in power system.	12

		2.6 Concept of DC voltage & current. 2.7 Types of loads. Standard single phase and three-phase distribution supply system.	
3. Electromagnetism	1. State Faradays law of electromagnetism. 2. Apply faradays law of electromagnetic induction. 3. Describe the nature of induced emf. 4. Define terms related to AC fundamentals 5. Compare terms time period and frequency, angular velocity and frequency, frequency and speed.	3.1 Electromagnetism-Introduction, Terms related to Electromagnetism. Faradays law of electromagnetic induction. 3.2 Direction of induced emf and current. Fleming right hand rule, Fleming left hand rule and Lenz law. 3.3 Nature of induced emf- I. Dynamically induced emf. II. Statically induced emf-its classification- i. Self induced emf ii. Mutual induced emf 3.4 AC Fundamentals-Generation of alternating voltage- single phase and three-phase. 3.5 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. 3.6 Maximum, average and R.M.S. value of sinusoidal waveform, form factor and peak factor.(No derivation)	08
4. Transformer	1. Define transformer. 2. Solve problems related to transformer. 3. Describe the concept of transformation ratio, KVA rating of transformer, voltage regulation and efficiency 4. Classify the different types of transformer. 5. Use auto-transformer, CT and PT for various applications.	4.1 Single phase Transformer – Principle of operation, working of transformer, types of transformer-shell type and core type, their construction, comparison, and applications 4.2 EMF equation (No derivation), transformation ratio, KVA rating of transformer, voltage regulation and efficiency (Simple Numerical problem based on emf equation & transformation ratio). 4.3 Auto-transformer –Special features, Schematic diagram and its applications. 4.4 Welding-transformer – Special features, Schematic diagram and its applications.. 4.5 Current Transformer and Potential Transformer- Special features, connection diagram and its applications.	12
5 Drives	1. Classify different types of AC & DC motors. 2. Select the particular motor	5.1 DC Drives- General working principle, types, application and selection for different applications	14

	for particular application. 3. Describe construction and working of DC machines and AC machines. 4. State the need of starter. 5. Control the speed of motor. 6. Predict the fault in motor.	,need of starter, 3 point starters, reversal of rotation, speed control methods(only DC shunt motor)- 1.armature control method,2.Flux control method. Concept of brushless DC motor. 5.2 AC Drives-Three phase induction motors - General working principle &their types, salient features, application and selection for different applications, need of starter, types of starter (only names), and reversal direction of rotation. 5.3Singlephase Induction motors- General working principle &their types (only names), application and selection for different applications, reversal of rotation. 5.4 Stepper motor-Introduction, principle, construction, working, and application of stepper motor.	
6. Wiring	1. Use different types of wiring accessories as per application.. 2. Select different accessories for particular type of installation. 3. Classify different types of wires. 4. Select suitable wire for the installation. 6. Choose cable for particular application. 7. Prepare the circuit of wiring. 8. Predict the faults in installation. 9. Use starter of three phase induction motors. 10. Use of Megger for measurement of insulation resistance of electrical installation.	6.1 Wiring accessories- test lamp, switches, Fuses, ICDP, ICDB, ICTP, MCB, ELCB, their selection, rating and application. 6.2 Wires –Introduction, Types, Specification and selection for particular use. 6.3 Cables- Introduction, Name of cables. 6.4 Wiring connections of lamp, fan, and fluorescent tube light etc, Different faults in electrical wiring circuit. 6.5 Wiring connections of three phase induction motors with starters and main switch. 6.6 Use of megger as insulation resistance tester.	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Use firefighting equipment on fire and execute safety precautions in laboratory.	Electrical safety	2
2	Connect voltmeter, ammeter and wattmeter in electrical circuit for measurement of electrical quantity.	Fundamentals of Electricity	2
3	Find unknown resistance using ohms law and observe the effect of temperature on resistance of conductor.		2
4	Measure the total resistance of series circuit & parallel circuit		2
5	Find the branch current and mesh voltage using Kirchhoff's laws. (KCL & KVL)		2
6	Measure different parameters by using tong tester and multimeter		2
7	Identify LV & HV winding of single phase transformer and test its polarity.	Transformer	2
8	Determine the voltage and current ratio of single phase transformer		2
9	Identify different parts of transformer.		2
10	Identify different parts of stepper motor.	Drives	2
11	Start D. C. Shunt motor by using 3 point starter and reverse the direction of rotation		2
12	Start Three phase Induction motor and reverse the direction of rotation.		2
13	Control the speed of D.C. shunt motor by using field control method and armature voltage control method.		2
14	Identify different electrical accessories & Use test lamps for testing single-phase and three-phase supply. Use of tester.	Wiring	2
15	Perform different test on electric motor such as continuity test, earth fault test, insulation resistance test by using Megger.		2
Skill Assessment			2
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Electrical Safety	02(00)	08(00)	00(06)	10(06)
02	Fundamentals of electricity	02(02)	08(00)	06(06)	16(08)
03	Electromagnetism	02(00)	04(04)	00(00)	06(04)
04	Transformer	02(04)	04(04)	06(00)	12(08)
05	Drives	02(00)	04(08)	06(00)	12(08)
06	Wiring	04(02)	04(04)	06(00)	14(06)
	Total	14(08)	32(20)	24(12)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	2	R	2	5/7
	6	R	2																
02	1	U	4	1	U	4	2	U	4	3	U	4	4	R	4				3/5
03	2	U	4	3	U	4	4	U	4	4	U	4	5	U	4				3/5
04	6	R	4	5	U	4	6	U	4	5	U	4	6	U	4				3/5
05	2	A	6	4	A	6	1	A	6										2/3
06	5	A	6	6	A	6	2	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram/ selection of equipment's/ writing procedure etc.	10
2	Performance/skill	20
3	Calculation/Result/ Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	1	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-
4	3	-	3	3	-	-	-	3	-	3	-	-
5	3	-	3	3	-	-	-	3	-	3	-	-
6	3	-	3	3	-	-	-	3	-	3	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Principle of Electrical Engineering and Electronics	V. K. Mehta, S Chand & Company Ltd., Reprint, 1996	81-219-1053-6
2.	A Text Book Of Electrical Technology Vol-I	B. L. Theraja, A. K. Theraja, S. Chand & Co Ltd., Reprint, 2006	81-219-2440-5
3.	Basic Electrical Engineering	V. N. Mittle, Arvind Mittal, The McGraw Hill Education Pvt. Ltd, Reprint, 2011	13: 978-0-07-059357-2
4.	Experiments in Basic Electrical Engineering	S. K. Bhattacharya and K. M. Rastogi., New Age International Publisher, Reprint, 2009.	978-81-224-1042-6
5.	A Text Book on laboratory courses in Electrical Engineering	S. G. Tarrekar and P. K. Kharbanda, S. Chand & Company Ltd., Third, 1990	13: 978-8121901048

❖ **E-REFERENCES:**

- <https://www.scribd.com/.../Lecture-Notes-Basic-Electrical-and-Electronic> assessed on 28th Feb 2016
- <https://www.youtube.com/watch?v=LAtPHANefQo> 31 mar 2016
- https://www.youtube.com/watch?v=vh_aCAHThTQ assessed on 31 mar 2016
- <http://nptel.ac.in/courses/108108076/1> , assessed on 18th January 2016
- www.studyaaar.com/index.../11-basic-electrical-a-electronics-engineerin assessed on 28th Feb 2016
- <https://www.youtube.com/watch?v=SpqwAasxY7U> assessed on 31 mar 2016.
- www.faadooengineers.com/.../448-BASIC-ELECTRICAL-ENGINEERIN assessed on 28th Feb 2016.
- <http://www.electrical4u.com> , assessed on 18th January 2016
- <https://www.youtube.com/watch?v=A9KSGAnjo2U>, assessed on 18th January 2016
- www.learnerstv.com/Free-engineering-Video-lectures-ltv059-Page1.htm assessed on 28th Feb 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. Wattmeter 0-3000 W
4. Digital Multi-meter
5. Rheostat assorted sizes
6. Variable Inductor
7. Megger 500V/1000V Hand driven.
8. Tong tester.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. C.S.Thorat	Principal	Government Polytechnic, Nagpur.
1.	Mrs. K. M. Gaidhane	I/C, Head of Electrical Engineering	Government Polytechnic, Nagpur.
2.	Mr. R. I. Kamble	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
3.	Mr. S. P. Thote	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
4.	Dr. R. S. Surjuse	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
5.	Mr. G. V. Gotmare	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
6	Mr. H, N. Kharkar	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
7	Mr. N. H. Adkine	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
8	Mrs. A. P. Gandhi	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGG
LEVEL NAME	: ENGINEERING SCIENCE AND TECHNICAL ART COURSES
COURSE CODE	: EC303E
COURSE TITLE	: ELECTRONICS AND MECHATRONICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02(CLOCK Hrs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH. TEE EXAM	: 03 HRS
PR. TEE EXAM	: 02 HRS (Internal)
PT EXAM	: 01 HR

❖ RATIONALE:

Modern equipments have electronic devices. Understanding the principles of electronic devices is therefore essential for diploma technicians. This course contemplates identification and testing of components, their principles of working of various electronic devices and signal conditioning. This subject also introduces the concepts of mechatronics and PLC.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply working principles of different electronic devices for system design.
2. Design a mechatronics system by integrating electronic, mechanical and control system components.
3. Design a system for measurement of a particular physical quantity using different sensors and transducers.
4. Operate various electronic test and measurement instruments and equipments.
5. Assemble different electronic circuits to obtain desired output.
6. Develop and execute different ladder programs on PLC.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Solid State Devices and Diode Circuits	1. Draw symbols of various components. 2. Describe the working principle of electronic components. 3. Enlist the applications of electronic devices. 4. Sketch the circuit diagram with relevant waveforms for rectifiers and filters. 5. Identify specific electronic component in a circuit. 6. Compare different rectifiers. 7. Compare different filters.	1.1 Solid State Devices: • Schematic symbols, applications and specifications of Resistors, Inductors, Capacitors • Schematic symbols, Working Principle, applications and V-I characteristics of – PN junction diode, Zener Diode, FET, UJT, SCR.BJT (only types) • Photo-devices –Schematic symbols, Working Principle, applications of LED Displays – 7-segment Display, LCD, Optocouplers(No Constructional details) 1.2 Diode Circuits: • Circuit Diagram, Working Principle, Waveforms and comparison of – Half wave Rectifier, Full wave Rectifier, Centre tap and Bridge Rectifier. 1.3 Filter Circuits: • Circuit Diagram, Working Principle, Waveforms and comparison of– C, LC, CLC	06
2 Basics of Digital Circuits	1. Draw the symbol for various logic gates. 2. Convert numbers in different number systems. 3. Write the truth table for various logic gates. 4. Compare microprocessor and microcontroller. 5. Define various terms related to microprocessors. 6. Enlist the features of microprocessors. 7. Enlist the features of microcontrollers. 8. Justify why NAND & NOR gates are called as Universal gates.	2.1 Number Systems: • Decimal Number System, Binary Number System, Conversion of Decimal to Binary and vice versa 2.2 Logic Gates: • Basic Gates: Symbols and truth tables of AND, OR, NOT. • Universal Gates: Symbols and truth tables NAND, NOR, Exclusive Gates: XOR, XNOR 2.3 Microprocessors • Terminology of microprocessors: Bit, Byte, Word, Nibble, Bus, Register, ALU, Program, Assembly Language, Compiler,	08

	9. Realize a given Boolean expression using logic gates.	Assembler, Flowchart. 2.4 Microcontrollers Basics of microcontroller-Busses and registers. 2.5 Features of 8085 and 8051 2.6 Comparison of microprocessor and microcontroller. 2.7 Applications of microprocessor and microcontroller	
3 Sensors & Transducers	- Define transducers. - Classify different types of transducers. - Select a particular transducer depending on the need of situation. - Design a system to measure a particular physical quantity by specific transducers. - Identify the type of sensor or transducer in a system used to measure a physical quantity. - State the principle of operation of different transducers.	3.1 Sensors - Definition of sensor - Types of sensors, Principle of working and applications of – - Pressure Sensors - Bourdon Tube - Temperature Sensors - RTD, Thermistors. iii. Photo sensors – Photodiode, LDR, LED iv. Proximity Sensors – Capacitive, Inductive 3.2 Transducers - Definition of transducer - Classification – Active/Passive, Primary/Secondary, Electrical, Mechanical, Optical and their examples - Selection Criteria for transducers - Principle of working and application of- - Displacement transducers - LVDT, RVDT - Strain Gauge, Load cell, Cantilever arm 3.3 Switches - Types and application of-SPST, SPDT, DPST, DPDT, Toggle switch, Push button switch 3.4 Relays - Principle of working and applications of – Electromagnetic, Dry reed relay 3.5 Encoders - Principle of working and applications of Rotary Encoder	12

4 Signal Conditioning	1. State the need of signal conditioning. 2. Describe the use of op-amp in signal conditioning process. 3. Select a particular op-amp based circuit depending on application. 4. Illustrate the process of analogue to digital signal conversion and vice-versa. 5. Describe the process of square wave generation. 6. Select a particular timer as per the requirement.	4.1 Necessity of signal conditioning 4.2 Block diagram of AC and DC signal conditioning 4.3 Block diagram, Working and applications of Operational amplifier IC741 • Virtual ground concept, • Inverting, Non inverting amplifier, • Integrator, Differentiator, 4.4 Wheatstone bridge its working principle and application. 4.5 Data Converters: Block diagram and working of successive approximation ADC, R-2R DAC 4.6 Timers: Block Diagram of IC555, Applications of timer as Astable Multivibrator(AMV), Monostable Multivibrator(MMV), Bistable Multivibrator(BMV), Comparison of AMV, MMV, BMV	10
5 Control Systems & Fundamentals of Mechatronics	1. Describe the basic control system. 2. Differentiate between different control systems. 3. Select a particular control system as per the need. 4. Describe the function of a servomotor. 5. Describe the function of a position control systems. 6. State the need of mechatronics. 7. Define sequential integration mechatronic system. 8. Define concurrent integration mechatronic system. 9. Enlist the objectives of mechatronics. 10. State the advantages, disadvantages of mechatronics. 11. Identify the various basic elements of mechatronics.	5.1 Control system • Definition of Control System • Classification of control system • Block diagram of control system • Operating Principle of open loop & closed loop control systems • Advantages, disadvantages of open loop and closed loop control systems • Transfer function of open loop and closed loop control system • Principle of Servomechanisms, Transfer function of AC and DC servomotor • Armature controlled and field controlled synchros, Synchros error detector with waveforms 5.2 Mechatronics • Origin and Evolution of mechatronics • Definition of Mechatronics- Sequential Integration, Concurrent Integration	15

	12. Describe the function of each module in mechatronics. 13. Derive the transfer function of a closed loop control system. 14. Derive the system for operating synchros as an error detector.	• Need for mechatronics in industry • Objectives of mechatronics • Modules in mechatronic systems • Examples of Mechatronics Systems – Automatic Camera, Automatic Washing Machine (Any One) • Advantages, disadvantages of mechatronics	
6 Programmable Logic Controller (PLC)	1. Describe the basic PLC architecture. 2. Describe the working of PLC. 3. Identify various components of a PLC. 4. Write simple ladder programs. 5. Develop a program to perform a given task using different instructions in PLC. 6. Develop the ladder logic for different instructions of PLC.	6.1 Introduction to PLC 6.2 General block diagram of hardware of PLC & Internal architecture of PLC 6.3 Development of ladder logic diagram – • Input & Output Instructions • Scan time, rungs, branching of rung, • Relays NO/NC contacts • Sourcing & sinking 6.4 Develop a program using following PLC Instructions – • Logical – AND, OR, NOT, NAND, NOR, XOR • Latching – latch, unlatch, binary Input/ output bit • Timers – TON, TOF, RTO, RES • Counter – CTU, CTD, RES • Comparators – LIM, EQU, NEQ, LES, LEQ, GRT, GEQ • Compute – ADD, SUB, MUL, DIV, SQRT,	13
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Operate a regulated power supply to set a constant voltage and current. • Use coarse and fine control knobs for precise voltage adjustment.	General Electronic Measurement techniques	2
2	Operate a function generator to generate different types of waveforms over a wide range of frequencies. • Use the function select knob to generate a particular waveform. • Use the DC offset knob to adjust the DC shift in a signal.		2

	Use the amplitude variable knob to adjust the amplitude of signal generated.		
3	Operate a Cathode Ray Oscilloscope to observe the output of a circuit. - Use Volt/div and time/div knobs for amplitude and frequency measurement - Use a particular channel in a dual trace oscilloscope. - Use Intensity and Focus front panel controls		2
4	Operate a digital multimeter to measure AC and DC voltage, AC and DC current, and resistance. - Test resistors, diodes and transistors. - Test continuity in a circuit		2
3	Identify different passive electronic components and solid state devices. - Draw the symbols for above devices - Identify their terminals and packages - Test above devices	Solid State devices and diode circuits	2
4	Assemble the circuit for half wave, full wave and bridge rectifiers (any one) and draw the waveforms at different points in the circuit.		2
5	Verify the truth table for various logic gates.	Basics of Digital Circuits	2
6	Measure linear displacement using LVDT.	Sensors & Transducers	2
7	Measure temperature using thermistor and thermocouple.		2
8	Assemble AMV using IC555 and draw the nature of output waveform generated.	Signal Conditioning	2
9	Assemble inverting and non-inverting amplifier using op-amp IC741.		2
10	Prepare a report on technical and commercial specifications of different modules of PLC available in market.	Programmable Logic Controller	2
11	Develop and execute simple ladder programs for PLC.		4
12	Develop and test the ladder logic for TON, TOF and RES instructions of PLC.		2
Skill Assessment			2
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Solid State Devices and Diode Circuits	02 (00)	08 (08)	00 (00)	10 (08)
02	Basics of Digital Circuits	02 (04)	04 (04)	06 (00)	12 (08)
03	Sensors & Transducers	04 (02)	08 (04)	00 (00)	12 (06)
04	Signal Conditioning	02 (00)	08 (00)	00 (06)	10 (06)
05	Control Systems & Fundamentals of Mechatronics	00 (02)	06 (04)	06 (00)	12 (06)
06	Programmable Logic Controller	04 (00)	04 (00)	06 (06)	14 (06)
TOTAL		14 (08)	38 (20)	18 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	3	R	2	4	R	2	3	R	2	5/7
	5	R	2																
02	1	U	4	1	U	4	2	U	4	1	U	4	2	U	4				3/5
03	3	U	4	4	U	4	4	U	4	1	U	4	3	U	4				3/5
04	3	U	4	6	U	4	6	R	4	2	R	4	5	U	4				3/5
05	5	U	6	5	A	6	4	A	6										2/3
06	2	A	6	6	A	6	6	A	6										2/3

T = Unit/ Topic Number

L = Level of Question

M= Marks

R – Remember

U – Understand

A- Analyse/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics &Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment's. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	-	-	-	3	-	-
2	3	-	-	-	-	-	-	-	-	3	-	-
3	3	-	-	-	-	-	-	-	-	3	-	-
4	-	-	2	2	-	-	-	2	-	3	-	-
5	-	-	2	2	-	-	-	2	-	3	-	-
6	-	-	2	2	-	-	-	2	-	3	-	-

1 – Slight (Low) 2 – Moderate (Medium) 3 – Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Textbook of Applied Electronics	R. S. Sedha, Revised Edition, S. Chand Limited, 2008	8121927838, 9788121927833
2.	Modern Digital Electronics	R. P. Jain, Tata McGraw-Hill Education, 2010, Fourth Edition.	0070669112, 9780070669116
3.	Microprocessor Architecture, Programming, and Applications with the 8085	Ramesh S. Gaonkar, 3rd Edition, Prentice Hall, 1996	0131988557, 9780131988552
4.	A Course in Electrical and Electronics Measurement and Instrumentation	A.K. Sawhney, Dhanpat Rai Publication, 10th Edition, 1994	
5.	Control System Engineering	U.A. Bakshi, V. U. Bakshi, Technical Publications, 2008	8184314639, 9788184314632
6	Mechatronics	W. Bolton, Pearson Education India	8131762572, 9788131762578

7	Mechatronics	Ganesh S. Hegde, Illustrated Edition, Jones & Bartlett Learning, 2010	1934015296, 9781934015292
8	Introduction to programmable Logic Controllers	Gary Dunning, Rockwell lab Manual for Dunning's Intro to Programmable logic Controllers, 2005	1401884261
9	Programmable logic Controllers	Bolton, 2006	0750681128

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Shri S. S. Tadas	HOD, Electronics	Government Polytechnic., Nagpur
2	Mrs. M. N. Bawane	Lecturer in Electronics	Government Polytechnic., Nagpur
3	Mrs. H. R. Bhusari	Lecturer in Electronics	Government Polytechnic., Nagpur
4	Mr. D. A. Brahmarkar	Lecturer in Electronics	Government Polytechnic., Nagpur
5	Ms. Giri K. G.	Lecturer in Electronics	Government Polytechnic., Nagpur
6	Mr. Sandeep Darwhekar	Director	Beta Computronics Pvt. Ltd., Nagpur
7	Mrs. Gazala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur
8	Mr. S. M. Kale	Lecturer in Electronics	Government Polytechnic., Gadchiroli

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: ENGINEERING SCIENCE AND TECHNICAL ART COURSES
COURSE CODE	: MT303E
COURSE TITLE	: MECHANICAL ENGINEERING MATERIALS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02 (CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT	: 01 HR

❖ RATIONALE:

Mechanical engineering students should have a good knowledge of composition, properties, and applications of engineering materials used in various field. In order to inculcate the same, this course is designed. Ferrous & Non ferrous metals and alloys find major applications. Amongst these, steels and cast iron are the main alloys with major applications in engineering practices. He should be able to identify steels and cast irons by their specifications and be able to select them for proper applications.. Powder metallurgy process also finds applications in manufacturing of special parts with typical properties. This course describes the composition, properties and applications of materials which is very useful for identifying and selecting the proper material in the field of mechanical engineering.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify different engineering materials.
2. Select proper engineering materials for specific application.
3. Choose different heat treatment processes.
4. Identify different microstructures of steel and cast iron
5. Prepare sample for microscopic examination.
6. Conduct different metallurgical tests on ferrous and non ferrous metals and alloys.

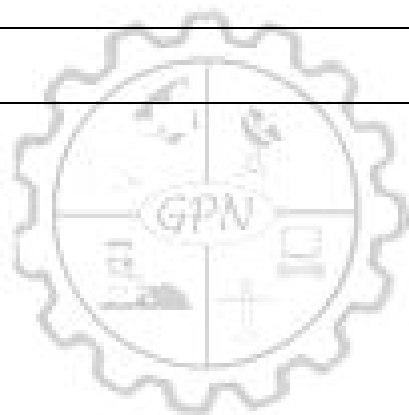
❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Engineering Materials - Structure and Properties	1. State the types of engineering materials 2. Differentiate amorphous and crystalline solid 3. State properties of material for engineering use 4. State the example of crystal structure. 5. Calculate atomic packing efficiency of different crystal structures.	1.1 Introduction, Classification of engineering materials with examples 1.2 Introduction to composite and foam-characteristics and applications 1.3 Amorphous solid and crystalline solid & its difference 1.4 Introduction to Ferrous metals, their Characteristics & applications. 1.5 Introduction to Non-Ferrous metals, their Characteristics & applications. 1.6 Crystal structure (BCC, FCC & HCP only), Unit cell and space lattice, concept of atomic packing efficiency 1.7 Properties of metals, Physical Properties & Mechanical Properties	06
2.Equilibrium diagrams	1. Define the phase diagram 2. Compare different solid solutions. 3. Draw and interpret Iron-Carbon diagram 4. State phases and composition of steels. 5. State critical temperature of steel 6. Identify the micro structure of cast iron and steel.	2.1 Definitions of phase or equilibrium or constitution diagram, pure metal, alloy and solid solutions. 2.2 Types of solid solutions – substitutional and interstitial 2.3 Solidification of pure metal and alloy with Cooling curves. 2.4 Iron - Carbon Equilibrium diagram, Microstructures of carbon steel and cast iron, Critical temperatures & its significance.	10
3.Ferrous metals and alloys:	1. Classify cast iron. 2. Identify Cast Iron from I.S. designation 3. Draw flow diagram of production of cast iron and steel. 4. State the effect of alloying element on alloy. 5. Define steel 6. Compare cast iron with steel 7. Classify steel. 8. Identify Cast Iron and Steel for proper application	3.1 Cast Iron: Classification, composition, characteristics and uses of different types of Cast Iron and alloy cast iron. I.S. Specifications of Cast Iron 3.2 Flow diagram for production of different types Cast Iron. 3.3 Steel: Definition & Properties, classification of steels on various basis as low , medium, high carbon steels, Hypo, Hyper eutectoid steels 3.4 Chemical composition, properties and applications of Low Carbon Steel, Medium carbon steel, High Carbon Steel. 3.5 Flow diagram for production of steel.	16

	9. State effect of alloying element on properties of steel 10. Select appropriate steels and cast irons for engineering applications	3.6 Alloy Steels: Definition & Classification of alloy steel. 3.7 Effects of alloying elements on mechanical properties of steels such as Cr, Ni, Mo, W and V 3.8 Composition and application of:- i) Tool steels: High speed steels (HSS), HCHC; ii) OHNS iii) Stainless Steels. 3.9 I.S. specifications of steels. 3.10 Selection of appropriate steels and cast irons for engineering applications	
4. Heat Treatment Of Steels	1. Locate phases on TTT diagram 2. Describe different types of heat treatment processes 3. Select temperature range for suitable heat treatment process 4. State the purpose of heat treatment 5. Identify proper heat treatment process 6. State the effect of cooling rate on properties 7. Recommend proper heat treatment process.	4.1 Time Temperature Transformation diagram for eutectoid steel only 4.2 Heat Treatment Processes: Purposes, temperature ranges, types and applications of: a. Annealing b. Normalizing c. Hardening d. Tempering 4.3 Surface Heat Treatment processes: Need of Surface heat treatment, Types of Surface hardening methods like Flame Hardening, Induction Hardening, Carburizing, and Nitriding.	16
5. Non ferrous Alloys	1. Compare brass with bronze 2. State applications of non ferrous alloys. 3. Select proper non ferrous alloys for given applications.	5.1 Chemical compositions, properties and applications of : a. Copper alloy: brasses and bronzes. b. Aluminium alloys : Y-alloy, Hindalium, duralium, Magnesium. c. Bearing materials: Lead based and Tin based.	08
6. Powder Metallurgy	1. Define terms related to powder metallurgy. 2. State different powder manufacturing processes. 3. Describe process flow sheet for manufacturing powder metallurgy product.	6.1 Advantages, limitations and applications of Powder Metallurgy for Engineering products. 6.2 Brief Description of Powder product manufacturing. e.g. powder making, blending, compacting, sintering, infiltration & impregnation.	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw crystal structure of different engineering materials.	Engineering Materials - Structure and Properties	4
2	Draw, locate and interpret various phases from Iron-Carbon equilibrium diagram.	Equilibrium diagram	6
3	Prepare Sample for microscopic examination of Cast Iron/ steel		6
4	Carry out any one process of heat treatment on plain carbon steel.	Heat Treatment Of Steels	6
5	Prepare powder metallurgical component (any one)	Powder Metallurgy	4
6	Perform test such as tensile test, hardness, impact test, spark test.(any one) and Predict mechanical behavior of materials.	Engineering Materials - Structure and Properties	4
Skill Assessment			02
Total:			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	.Engineering Materials - Structure and Properties	02(00)	04(04)	00(00)	06(04)
02	Equilibrium diagram	04(02)	06(04)	00(00)	10(06)
03	Ferrous metals and alloys	02(02)	08(08)	06(00)	16(10)
04	Heat Treatment Of Steels	02(00)	08(04)	06(06)	16(10)
05	Non ferrous Alloys	02(00)	04(04)	06(00)	12(04)
06	Powder Metallurgy	02(00)	08(00)	00(06)	10(06)
	Total	14(04)	38(24)	18 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	1	R	2	5/7
	3	R	2																
02	2	R	4	1	U	4	2	U	4	2	U	4	2	U	4				3/5
03	5	R	4	2	U	4	3	U	4	4	U	4	5	U	4				3/5
04	5	U	4	6	U	4	6	U	4	5	U	4	5	R	4				3/5
05	2	U	6	3	A	6	4	A	6										2/3
06	4	A	6	5	A	6	6	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing phase diagram, selection of material. writing procedure etc.	10
2	Performance	10
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva voce	20
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	–	–	–	–	–	–	3	–	3	3	–
2	3	–	–	–	–	–	–	3	–	3	3	–
3	3	–	–	–	–	–	–	3	–	3	3	–
4	3	–	2	2	–	–	–	3	2	3	3	–
5	3	–	2	2	–	–	–	3	2	3	3	–
6	3	–	2	2	–	–	–	3	2	3	3	–

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Material science & Metallurgy for engineers	V. D. Kodgire, S. V. Kodgire, Everest Publishing House, first edition, 2011	10:8186314008 13:9788186314005
2.	Engineering Materials & Metallurgy	R. Srinivasan, Tata McGraw Hill Education Pvt. Ltd, first edition 1994	13- 978-0-07-067281-9
3.	Heat Treatment: Principles and Techniques	T. V. Rajan, C. P. Sharma, Ashok Kumar Sharma, Prentice Hall Of India. 2nd edition, 1994	978-81-203-4095-4
4.	Powder Metallurgy	Anil Kumar Sinha, Dhanpat Rai Publications , 1st Edition , 1981	4567144058

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=98lh5Q0M0cg>, assessed on 16th March 2016
- https://www.youtube.com/watch?v=3_BH6HqpPtk, assessed on 16th March 2016
- <https://www.youtube.com/watch?v=eHFI-xuZliQ>, assessed 16th March 2016
- <http://www.engmatl.com/index.php?start=6>, assessed on 16th March 2016
- <http://downloadingisnotsin.net/material-science-and-metallurgy-by-kodgire-pdf-free-download/>, assessed on 22nd March 2016
- <http://scitech.quickfound.net/>, assessed on 27th April 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Models of crystal structure-(FCC,BCC,HCP)
2. Standard Fe-Fe₃C equilibrium diagram
3. Microscope- magnification 100X
4. Grinder- Double ended
5. Polishing machine- cloth polished, rotating disc type
6. Muffle furnace- max temperature 1000⁰c
7. Hardness tester- Rockwell c scale
8. Different Metallurgical products

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. K. L. Meshram	HOD, Metallurgical Engineering	Government Polytechnic, Nagpur.
2.	Mr. D. K. Mukharjee	Retired Senior Metallurgist	Ordnance Factory, Ambazari, Nagpur
3.	Mr. G. H. Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Mr. Y.Y. Mahajan	Assist. Professor , Metallurgy & Material Science	VNIT Nagpur
5.	Mr. S. B. Varadpande	Managing director	Orange city alloys Pvt. Ltd Nagpur
6.	Mr. Y. K. Gaiky	Lecturer Mechanical Engineering	Government Polytechnic, Sakoli

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/AE
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: ME303E
COURSE TITLE	: THERMAL ENGINEERING
PREREQUISITE	: NIL
TEACHING SCHEME:	TH:04; TU:00;PR:00 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: NIL
PT. EXAM	: 01 HR

❖ **RATIONALE:**

Thermal Engineering is a core subject in mechanical engineering. This course includes the study of basic laws & concept of thermodynamics, gas laws, properties of steam and steam generation. Mechanical engineer should understand working and application of various processes of thermal power plants.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply fundamental concepts and laws of thermodynamics to thermodynamic systems.
2. Illustrate the concept of steam generation, steam properties and vapour processes.
3. Analyze the construction and working of boiler and its mountings.
4. Interpret the construction and working of condenser and cooling towers.
5. Interpret the construction and working of steam turbine and Nozzle
6. Illustrate the different modes of heat transfer.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Basic Concepts	1. Define fundamental concept of thermodynamics. 2. Apply first law of thermodynamics to various thermodynamic devices. 3. Apply second law of thermodynamics. 4. State ideal gas laws. 5. Represent various ideal gas processes on P-V and T-S diagram.	1.1 Thermodynamic system, boundary, surrounding, Thermodynamic properties, state, process, path of the system, Reversible and irreversible processes, Energy, Work and heat. Reversible work. Zeroth Law of Thermodynamic. (Simple Numerical). 1.2 First Law of Thermodynamic Concept of perpetual Motion machine 1, Application of first law of Thermodynamic to Non flow or closed system. And steady flow process, Enthalpy, Ideal gas laws, gas equation. Characteristic & universal gas constants, representation of various gas processes on P-V and T-S diagram. Specific heat at constant pressure & constant volume, ratio of specific heats. (Simple Numerical). 1.3 Limitation of first law of thermodynamics, Second Law Of Thermodynamics, Kelvin Plank & Clausius statement, clausius Inequality, Application of Second law to Heat Engine, Heat Pump and refrigerator, COP of Refrigerator, PMM-II, and Entropy, Entropy change in reversible and irreversible processes. (Simple Numerical)	18
2. Steam Generator	1. State the concept of steam generation. 2. Calculate the properties of steam 3. Use of steam tables and mollier chart. 4. Describe construction and working of different types of boilers and functions of boiler mountings and accessories 5. Describe boiler draught	2.1 Generation of steam at constant pressure with representation on various charts such as T-S, H-S. Properties of steam and use of steam table, Mollier chart, (Numerical based on properties) 2.2 Principles of steam generation in high pressure boiler, classification of boilers, Water tube boiler and fire tube boiler, Introduction of high pressure boiler Lamont, Benson, Loffler, Velox boilers 2.3 Boiler draught- natural & artificial, relative merits & demerits, list of boiler mountings and Accessories & its function	14

3. Vapour Cycle	1. Represent various vapour processes on P-V and T-S diagram. 2. Describe various vapour cycles. 3. Draw various cycles on P-V and T-S diagram.	3.1 Vapour processes:-Constant pressure, Constant temperature, constant volume, constant enthalpy, constant entropy process 3.2 Concept of Carnot cycle, Rankine cycle, P-V and T-S diagram of Carnot cycle and Rankin cycle.	04
4. Condensers & Cooling Towers	1. Apply Dalton's law to condenser. 2. Describe construction and working of condensers and cooling tower. 3. Calculate condenser efficiency, vacuum efficiency 4. State the effect of air leakage in condenser.	4.1 Dalton Law of partial pressure Functions of condensers, classification of condensers, Construction and working of jet and surface condensers, 4.2 Sources of air leakage and its effect, concept of condenser efficiency, vacuum efficiency(numerical based on efficiency) 4.3 Cooling Tower-Construction and working of forced, natural and induced draught cooling tower.	10
5. Steam Nozzle & Turbine	1. Define Mach number and critical pressure. 2. State the application of steam nozzles. 3. Describe the principle of working of steam turbine. 4. Compare Impulse and reaction Turbine 5. Describe the Methods to improve efficiency of turbine, 6. Describe necessity of Compounding of turbines	5.1 Steam nozzle: - Concept of Mach number and critical pressure, Continuity equation, types of nozzles, equation for exit velocity, Application of steam nozzles. Efficiency of nozzles.(no numerical) 5.2 Steam turbine: - Classification of turbines, Principle of operation, working of Impulse and Reaction turbine. Basic difference between Impulse and reaction Turbine, Methods to improve efficiency of turbine, Compounding of turbines. (No numerical)	14
6. Heat Transfer	1. Describe various modes of heat transfer. 2. Define various terminology used in radiation	6.1 Modes of heat transfer:-Conduction, Convection and radiation, Fourier's law. 6.2 Radiation;-Thermal radiation,Absorptivity,Transmissivity, Reflectivity,Emissivity,Black and Gray body	04
Total Hrs.			64

❖ LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assignment	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
Nil			

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Basic Concept	02(00)	08(04)	06(06)	16(10)
02	Steam Generator	06(00)	04(06)	04(00)	14(06)
03	Vapour Cycle	00(04)	08(00)	00(00)	08(04)
04	Condensers and Cooling Towers	04(02)	10(00)	00(06)	14(08)
05	Steam Nozzles and Turbines	04(02)	04(04)	06(00)	14(06)
06	Heat Transfer	04(02)	00(04)	00(00)	04(06)
	Total	20(10)	34(18)	16(12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	U	2	1	U	2	6	R	2	2	R	2	4	R	2	5/7
	5	R	2																
02	1	U	4	2	U	4	3	R	4	4	R	4	5	R	4				3/5
03	3	U	4	4	U	4	5	U	4	6	R	4	1	U	4				3/5
04	2	A	4	2	R	4	5	U	4	3	U	4	6	U	4				3/5
05	1	A	6	4	A	6	2	U	6										2/3
06	4	U	6	5	A	6	1	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	--	--	--	--
				TOTAL	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
NIL		

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:****For Mechanical Engineering:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	3	3	–	–	–	3	–	3	3	–
2	–	3	3	3	–	–	2	3	1	3	3	–
3	–	3	3	3	–	–	–	3	–	3	3	–
4	–	3	3	3	–	–	–	3	–	3	3	–
5	–	3	–	–	–	–	2	3	–	3	3	–
6	–	3	–	–	–	–	–	3	1	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

For Automobile Engineering:

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	3	3	–	–	–	3	–	3	–	–
2	–	3	3	3	–	–	2	3	1	3	–	–
3	–	3	3	3	–	–	–	3	–	3	–	–
4	–	3	3	3	–	–	–	3	–	3	–	–
5	–	3	–	–	–	–	2	3	–	3	–	–
6	–	3	–	–	–	–	–	3	1	3	–	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Thermal Engineering: Engineering Thermodynamics and Energy Conversion Techniques	P.L. Ballaney, Khanna Publishers, 24 th Edition, Reprint 2011	10: 8174090312

2	Thermal Engineering	D. K. Chavan & G.K.Pathak, Standard Publishing House, 2 nd Edition, 2013	978-81-89401-20-7
3	Thermal Engineering	R.K.Rajput, Laxmi Publications (P) Ltd. 9 th Edition, 2015	9788131808047
4	Thermal Engineering	S.L. Somasundaram, New Age International Publisher, 1996	10: 8122409792 13: 978-8122409796
5	Thermal Engineering Vol. I (Thermodynamics And Heat Engines)	Dr. S.S. Khandare, Charotar Publishing House Pvt. Ltd., 2008	9788185594682
6	Thermal Science and Engineering	Dr. M.L.Mathur& Prof. F.S. Mehta, Jain Book Depot (JBD), 3 rd Reprint, 2013	9788183600835

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=aC7c1NgA-7M>, assessed on 23rd March 2016
- <https://www.youtube.com/watch?v=is5wdVgPOkI>, assessed on 23rd March 2016
- <https://www.youtube.com/watch?v=Wz62eqg0kqs>, assessed on 28th March 2016
- <https://www.youtube.com/watch?v=UW7Pm3kXJT8>, assessed on 28th March 2016

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr.O.V.Sarode	I/C HOD, Mechanical Engineering	Government Polytechnic Nagpur
2.	Mr.S.W.Rajurkar	Lecturer , Mechanical Engineering	Government Polytechnic Nagpur
3.	Mrs.M.D.Kothekar	Lecturer , Mechanical Engineering	Government Polytechnic Nagpur
4.	Mr.K.S.Thekedar	Lecturer , Mechanical Engineering	Government Polytechnic Nagpur
5.	Mr. Mahesh Khanna	Deputy Manager	Ashok Leyland Ltd. Bhandara
6.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
7.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
8.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)

(Chairman PBOS)

LEVEL - IV

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/PK
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME401E
COURSE TITLE	: ENGINEERING DRAWING
PREREQUISITE	: ME301E
TEACHING SCHEME:	TH:02; TU:00;PR:04 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 04 HRs
PR. TEE	: NIL
PT. EXAM	: 02 HRs

❖ RATIONALE:

This course is classified as professional course. It describes the fundamentals, facts, concepts, principles and techniques of Engineering drawing. The course illustrates techniques of drawing in an engineering field. The concepts of drawing language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. 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 machine drawing and other allied courses.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Relate the views of an object for drawing sectional views and missing views.
2. Interpret the technique of projection of lines , planes ,projection of solids and projection of section of solids
3. Apply the technique of freehand sketches and welded joints.
4. Sketch sectional views and missing views.
5. Draw projection of lines, planes, projection of solids and section of solids.
6. Sketch appropriate freehand sketches of machine component and welded joints.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Sectional Orthographic views	1. Visualize given pictorial view. 2. Draw sectional views.	1.1 Types of sections and conversions of pictorial views into sectional orthographic views. (complete objects involving Slots, ribs etc)	05
2. Missing views	3. Visualize given views. 4. Draw missing views	2.1 Draw missing view from the given orthographic views.	05
3. Projection of lines and planes	1. Draw projections of lines and locate its traces. 2. Draw projections of planes.	3.1 lines inclined to both the reference planes .Locate H.T., V. T.(limited to both ends in first quadrant) 3.2 Projection of simple planes.eg. circular, square, rectangular ,rhombus, pentagonal and hexagonal. inclined to one reference plane and perpendicular to other (first angle method of projection only)	08
4 Projection of solids	1. Visualize different types of regular solids. 2. Draw the projections of regular solids.	4.1 Projections of prisms, pyramid, cone, cylinder, tetrahedron and cube, with their axes inclined to one reference plane and parallel to other.	05
5. Section of solids	1. Visualize cut models of different types of regular solids. 2. Draw the projections of different cut models of regular solids.	5.1 Prism and cylinder-Axis inclined to one reference plane and parallel to other, Axis parallel to both the reference plane. Whereas section plane is inclined to one reference plane and perpendicular to other. 5.2 Cone , Pyramid, Cube Tetrahedron , - Axis inclined to one reference plane and parallel to other ,where as section plane is inclined to one reference plane and perpendicular to other .	05
6. Free hand sketches	1. Draw proportionate freehand sketches of given machine elements 2. Select proper fasteners and foundation bolts	6.1 keys:- sunk, saddle, taper, woodruff, and cone . 6.2 Couplings:- Muff, flange, Oldham , 6.3 Pulleys:- Flat belt, V-belt, fast and loose pulleys. 6.4 Welding symbols and welded joints. 6.5 Pipe joints and fitting.- Flanged joint, socket and spigot joint , union joint .Nipple, coupler, Reducing socket, tee, cross, plug, elbow and bend .	04
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw two problem on sectional orthographic views. (01 Sheet)	1. Sectional Orthographic views	10
2	Draw two problem on Missing views. (01 Sheet)	2. Missing views	08
3	Draw two problems on projection of lines and planes each . (01 Sheet)	3. Projection of lines and planes	12
4	Draw two problems on projection of solids. (01 Sheet)	4 Projection of solids	12
5	Draw two problems on section of solids. (01 Sheet)	5. Section of solids	12
6	Draw Free Hand Sketches of the following- Any two keys , any one pulley, any one coupling, any one welded joint, any one pipe joint. (01 Sheet) (All welding symbols and all pipe fittings are to be drawn in the practical sketch book)	6. Free hand sketches	10
Total Hrs.			64
Note:-Use A2 Size of drawing sheets.			

C. LIST OF ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw five problems on sectional orthographic views.(On Practical sketch book)	1. Sectional Orthographic views	---
2.	Draw five problems on Missing views. (On Practical sketch book)	2. Missing views	---
3.	Draw five problems on projection of lines and planes each .(On Practical sketch book)	3. Projection of lines and planes	---
4.	Draw five problems on projection of solids. (On Practical sketch book)	4 Projection of solids	---
5.	Draw five problems on section of solids.(On Practical sketch book)	5. Section of solids	---
6.	Draw Free Hand Sketches of the following- keys , pulleys, couplings, welded joints, pipe joints & fittings. (On Practical sketch book)	6. Free hand sketches	---

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Sectional Orthographic views	00(00)	12(00)	00(00)	12(00)
02	Missing views	00(00)	00(00)	12(00)	12(00)
03	Projection of lines and planes	00(00)	14(08)	00(00)	14(08)
04	Projection of solids	00(00)	10(10)	00(00)	10(10)
05	Section of solids	00(00)	00(00)	10(10)	10(10)
06	Free hand sketches	12(08)	00(00)	00(00)	12(08)
	Total	12(08)	36(18)	22(10)	70 (36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	U	12																1/1
02	2	A	12																1/1
03	3	U	6	3	U	8	3	U	8										2/3
04	4	U	10	4	U	10													1/2
05	5	A	10	5	A	10													1/2
06	6	R	4	6	R	4	6	R	4	6	R	4	6	R	4				3/5

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Drawing Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Practical Sketch Book	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Drawing Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Drawing Portfolio		Continuous	05	--	Drawing Portfolio	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	Nil	

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	3	3	3	–	–
2	–	3	–	–	–	–	–	3	3	3	–	–
3	–	3	–	–	–	–	–	3	3	3	–	–
4	–	3	3	3	–	–	–	3	3	3	3	–
5	–	3	3	3	–	–	–	3	3	3	3	–
6	–	3	3	3	–	–	1	3	3	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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	81-7061-091-2
2.	Engineering Drawing	N. D. Bhatt, Charotar Publishing house 2010	978-93-80358-17-8
3.	Machine Drawing	N. D. Bhatt & V. M Panchal, Charotar Publishing house 2010	978-93-80358-11-6
4	Engineering Drawing	D. A. Jolhe, Tata McGraw-Hill Edu. 2010	978-0-07-064837-1
5.	Engineering Drawing	R. K. Dhawan , S. Chand & co.	81-219-1431-0
6	Engineering Drawing	P. J Shaha, S. Chand & co. 2008	81-219-2964-4

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=TJ4jGyD-WCw>, assessed on 25th March 2016
- https://www.youtube.com/watch?v=dmt6_n7Sgcg, assessed on 25th March 2016
- https://www.youtube.com/watch?v=_MQScnLXL0M, assessed on 26th March 2016
- <https://www.youtube.com/watch?v=3WXPanCq9LI>, assessed on 26th March 2016
- <https://www.youtube.com/watch?v=fvjk7PlxAuo>, assessed on 27th March 2016
- <http://www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf>, assessed on 27th March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 1) Drawing Board with drawing instruments
- 2) Minidrafter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. O. V. Sarode	I/C HOD, Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. M.G. Thote	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. G.H Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Mr. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/AE/PK
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: AM407E
COURSE TITLE	: STRENGTH OF MATERIAL
PREREQUISITE	: AM301E
TEACHING SCHEME	: TH:03; TU:01;PR:02(CLOCK HRs.)
TOTAL CREDITS	: 05(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT :	: 01 HR

❖ RATIONALE:

Concepts and principles involved in the analysis and design of various machines and machine components along with mechanical properties of engineering materials in Mechanical Engineering, Automobile engineering and Packaging technology are covered in this course. Design and analysis of machines and its components needs the basic understanding of mechanical properties of material and their behavior under stress. The approach of teaching should develop critical thinking in the students. In laboratory the experiments integrate the knowledge and desired skill in students.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Develop an understanding of the behaviour of material and components subjected to various types of loading
2. Analyse and design engineering problems subjects to various forces.
3. Select appropriate materials considering engineering properties, economy, safety and sustainability.
4. Draw shear force diagram, bending moment diagram, bending stress and shear stress diagrams.
5. Prepare the specimen as per Indian standard (IS) specifications, fix it and operate the machine to carry out the test.
6. Record the readings and the behaviour of material till fracture and analyse its failure pattern

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Simple Stress And Strain	1 Define various terms and compute their values 2.Calculate Material Properties Under Longitudinal & Lateral Loads 3 Analyse Composite & Compound stress systems 4 Calculate design constants for various conditions. 5 Calculate the change in dimensions and volume of the body subjected to uniaxial, biaxial and triaxial loads/stresses. 6 Calculate the stress, strain due to temperature variation in homogeneous and compound bars. 7 Compute Strain Energy under Different Types of Loading	1.1 Definition of stress, strain, elasticity. Definition of rigid, elastic and plastic bodies. Deformation of elastic body under various forces. 1.2 Type of stresses-normal and tangential, normal tensile and compressive stresses, standard stress strain curve for mild steel bar under tension test, Hook's law, elastic limit, modulus of elasticity, factor of safety, yield and working stresses. 1.3 Stress and strain in composite section under axial loading. 1.4 Stress and strain due to temperature variation developed in homogeneous and composite bars. 1.5 Longitudinal and Lateral strain, Poisson's ratio, biaxial and triaxial stresses, volumetric strain, change in volume, Bulk modulus. 1.6 Shear stress and strain, modulus of rigidity, complementary shear stress and induced tension and compression due to it. 1.7 Relation between modulus of elasticity, modulus of rigidity and bulk modulus. 1.8 Differentiate between Sudden, Gradual & Impact Loads 1.9 Define Strain Energy, Proof Resilience modulus of resilience. 1.10 Strain energy stored in a body when subjected to gradual, Sudden and impact load	08
2. Shear Force & Bending Moment	1 Define various terms and compute their values 2. Draw Shear Force & Bending Moment Diagram for Statically Determinate Beams. 3 Calculate the shear force and bending moment for determinate beams with load combinations of point	2.1 Type of beams, supports and loads. 2.2 Concept and definition of shear force and bending moment. 2.3 Shear force and bending moment diagram for simply supported, cantilever and over hanging beams subjected to point loads and uniformly distributed loads only. 2.4 Point of maximum sagging and hogging bending moment, point of	08

	load and uniformly distributed load. 4 Differentiate shape of shear force diagram and bending moment diagram for point load and uniformly distributed load.	contra-flexure, Relation between load, shear force and bending moment.	
3. Moment of Inertia	1 Define various terms and compute their values 2. Compute Moment of Inertia of Symmetric & asymmetric structural sections using parallel and perpendicular axes theorems.	3.1 Definition, M.I. of plane lamina, radius of gyration, parallel and perpendicular axes theorems, M.I. of rectangular, circular semicircular and triangular section 3.2 M.I. of symmetrical and Unsymmetrical I-section, channel section, T-section, angle section, & Hollow sections and built up section about centroidal axes 3.3 Polar Moment of Inertia of circular sections.	08
4. Principal Planes and Stresses	1. Define terms related to principal planes and principal stresses 2. Calculate Principal Stresses & Principal Plane on a plane in a Strained structural Material 3. Calculate Principal stresses graphically by Mohr's Circle	4.1 Definition of principal plane, oblique plane. 4.2 State of stress at a point in two dimensional stress system, different states of stresses. 4.3 Mohr's circle, application of Mohr's circle. 4.4 Resultant stress, principal stresses – major and minor, position of principal planes	06
5 Columns, Direct and Bending Stresses	1. Define terms related with Columns 2. State end conditions of column 3 Define Effective length, radius of gyration, slenderness ratio Euler's buckling load 4. State Assumptions made in Euler's theory, Euler's buckling load 5 Calculated Crippling load by Eulers and Rankines Formula 6. Stresses of various structural components 7. Calculate direct and bending Stresses of a rectangular, square and circular column	5.1 Definition, short column, long column, type of end conditions for columns, Buckling of axially loaded columns.. 5.2 Effective length, radius of gyration, slenderness ratio, Assumptions made in Euler's theory, Euler's buckling load 5.3 Rankine's formula used for calculated crippling loads. 5.4 Concept of bending stresses, Equation of bending. 5.5 Concept of direct and eccentric loads Short compression member (Rectangular, square, circular sections) subjected to eccentric loads about any one or both the centroidal axis.	08

6.Thick and Thin Cylindrical Shell	1. State torsional equation and moment of resistance for circular shaft 2. State assumption made in theory of pure torsion 3 Calculate shear strength , torsional rigidity and polar modulus of circular and hallow shaft 4.Define thin, thick cylindrical shell, Circumferential and longitudinal stresses.. 5.Calculate Circumferential and longitudinal strain and stresses and volume due to internal pressure of cylindrical shell	7.1 Theory of torsion, Torsional equation, Moment of resistance, Assumption made in theory of pure torsion. 7.2Shear stress distribution across the section of circular shaft, strength of circular shaft, polar modulus 7.3Stresses in walls of thin cylindrical shells due to internal pressure, circumferential and longitudinal stresses 7.4Change in dimensions and volume of cylindrical shell due to internal pressure. 7.5Thin spherical shells, change in diameter and volume due to internal pressure (No derivation).	04
7.Torsion	1. State torsional equation and moment of resistance for circular shaft 2. State assumption made in theory of pure torsion 3 Calculate shear strength , torsional rigidity and polar modulus of circular and hallow shaft	7.1 Theory of torsion, Torsional equation, Moment of resistance, Assumption made in theory of pure torsion. 7.2Shear stress distribution across the section of circular shaft, strength of circular shaft, polar modulus	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
GROUP A (ATLEAST 2)			
1	Operate Universal testing machine for different types of test.	1. Simple Stress And Strain	02
2	Measure the elongation of steel by using Extensometer.	1. Simple Stress And Strain	02
3	Operate Compression testing machine for compression test.	1. Simple Stress And Strain	02
GROUP B (ATLEAST 6)			
4	Perform Tension test on mild steel plane bar.	1.Simple stress and strain	02
5	Perform Tension test on HYSD steel.	1.Simple stress and strain	02
6	Perform Shear test on different metals.	1.Simple stress and strain	02
7	Perform Izod impact test.	1Strain Energy	02
8	Perform Brinell's hardness test.	1.Simple stress and strain	02
9	Perform Compression test on metals.	1.Simple stress and strain	02
10	Perform Flexure test on wooden and steel beam.	5.Direct and bending stresses	02
11	Perform Torsion In Circular Shaft	6.Torsion	02
GROUP C: LIST OF DRAWING SHEETS			
12	Draw shears force and bending moment diagrams of different types of beams and loadings. (Four problems on – Two A2 sizesheets.)	2 Shear force & bending moment	08
13	Draw Mohar's circle for Principal planes and stresses(Four problems on –Two A2 size sheet)	6.Principal stresses and planes	06
Skill Assessment			02
Total Hrs			32

C. LIST OF TUTORIALS:

Tutorials	
Numericals based on- Simple stress strain, Shear force and bending moment, Moment of Inertia	08
Numericals based on -Principal planes, Direct and bending, Thin cylinders, Torsion	08
Total Hrs.	16

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Simple stress and strain	04(02)	04(06)	08(00)	16(08)
02	Shear force & bending moment	02(02)	06(06)	04(00)	12(08)
03	Moment of inertia	02(00)	04(00)	00(04)	06(04)
04	Principal plane and stresses	02(00)	06(04)	00(00)	08(04)
05	Columns, direct and bending stresses	00(00)	06(04)	08(04)	14(08)
06	Thin and thick cylindrical shell	00(00)	08(00)	00(04)	08(04)
07	Torsion	00(00)	00(00)	06(04)	06(04)
	Total	10(04)	34(20)	26 (16)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	3	R	2	4	R	2	1	R	2	5/7
	2	R	2																
02	1	U	4	3	U	4	4	U	4	5	U	4	6	U	4				3/5
03	1	A	4	2	A	4	3	A	4	5	A	4	6	A	4				3/5
04	1	A	4	4	A	6	5	A	4	6	A	4	7	A	4				3/5
05	1	A	6	2	U	6	4	A	6										2/3
06	2	U	6	5	U	6	7	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing free body diagram, selection of equipment's. writing procedure etc.	20
2	Calculation, Result, Drawing Graphs(if any)	10
3	Viva voce	20
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	-	-	-	3	-	-
2	3	-	-	-	-	-	-	-	-	3	-	-
3	3	-	-	-	-	-	-	-	-	3	-	-
4	3	-	2	2	-	-	2	2	-	3	-	-
5	3	-	2	2	-	-	2	2	-	3	-	-
6	3	-	2	2	-	-	2	2	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Strength of Materials, Vol. I: Elementary Theory and Problems	S. Timoshenko, CBS; 3rd edition , 2004	978-8123910307
2	Mechanics of Materials	Timoshenko Gere, CBS; 2nd edition, 2006	978-8123908946
3	Mechanics of Materials	R.C. Hibbeler , Pearson Education; 9th edition , 2013	978-9332518605
4	A Textbook of Strength of Materials	Dr. R.K. Bansal , Laxmi; Publications(P) Ltd. 5th edition, 2012	978-8131808146
5	Strength of Material	R. S. Khurmi., S. Chand & Co. Ltd.	978-8121928229
6	Strength of Material	S. Ramamurtham, Dhanpat Rai Publishing Co.	818743354X, 9788187433545
7	Mechanics of Structure Vol 1	S. B. Junnarkar and H. J. Shah, Charotar Publishing House Pvt. Ltd., 2012	978-9380358659
8	Strength of Material	Sunil S. Deo, Nirali Prakashan , 2013	978-9383073283

❖ E-REFERECNES:

- https://www.youtube.com/feature=player_detailpage, assessed on 28th Sep.2016
- https://www.youtube.com/watch?v=InEpKIYBkvk&feature=player_detailpage assessed on 28th Sep.2016
- https://www.youtube.com/watch?v=l20kF6fhScA&feature=player_detailpage assessed on 28th Sep.2016
- https://www.youtube.com/watch?v=RJXJpeH78iU&feature=player_detailpage assessed on 28th Sep.2016

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION

- Universal Testing machine of capacity 400kN,600 kN/1000kN, analog type/digital type with all attachments and accessories.
- Extensometer with least count 0.01mm, maximum extension 25 mm with single dial gauge/ digital display suitable for various gauge length
- Compression testing machine of capacity 2000KN, analog /digital type having facility to measure deformation with all attachments and accessories.
- Izod/Charpy impact testing machine confirming to IS:1757.
- Tile flexural testing machine confirming to IS:654,capacity 200Kg with uniform loading rate of 45 to 55 Kg/minute provided with lead shots
- Hot Air Oven with thermostatic control having temp. range 100 to 105° C
- Accessories: venire caliper, meter scale, weighing balance, weights, punch, file, hammer, screw driver, pliers ,etc.

❖ WHO CONTRIBUTED FOR THIS CURRICULUM:

S.N.	Name	Designation	Institute / Industry
1.	Y.K. Chandarana	Head of Applied Mechanics Dept.	Government Polytechnic, Nagpur.
2.	Prof. A.P.Waghmare	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur.
3.	Prof A.G.Bhaiswar	Lecturer in Applied Mechanics	Government Polytechnic, Nagpur.
4.	M. R. Shelote	Consultant	M. R. Associates, Nagpur
5.	Dr. R. N. Khapre	Associate Professor	RCOE, Nagpur
6.	A. J. Fulzele	Assistant Secretary (Tech.)	MSBTE, RO, Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/PK
LEVEL NAME	: PROFESSIONAL COURSES.
COURSE CODE	: ME402E
COURSE TITLE	: MACHINE DRAWING
PREREQUISITE	: ME401E
TEACHING SCHEME	: TH: 03; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 05 (1TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 04 HRs
PR. TEE	: NIL
PT.	: 02 HR

❖ **RATIONALE:**

This course is classified as professional course. It describes the fundamentals, facts, concepts, principles and techniques of Machine drawing. The course illustrates techniques of drawing in an engineering field. A Mechanical Engineer, irrespective of their field of operation in an industry, is expected to possess a thorough understanding of drawing, which includes clear visualization of objects and the proficiency in reading and interpreting a wide variety of production drawings. Besides, they are also expected to possess certain degree of drafting skills depending upon job function, to perform day to day activity i.e. communicating and discussing ideas with supervisors and passing on instructions to subordinates. This course envisages reinforcing and enhancing the knowledge and skill acquired in the earlier two courses viz. Engineering Graphics & Engineering Drawing.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Interpret the projection of auxiliary views and development of surfaces of solids.
2. Interpret intersection of solids and technique of conventional representation as per SP46.
3. Interpret the technique of drawing details and assembly of machine components
4. Draw the projection of auxiliary views and development of surfaces of solids
5. Draw the projections of intersection of solids and conventional representation as per SP46.
6. Draw the details and assembly of machine components

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Development of surfaces of solid.	1. Develop the lateral surfaces of various solids with its engineering applications.	1.1 Develop the lateral surfaces of regular solids viz. Prism, cylinder, Pyramid, Cone. 1.2 Development of surfaces of solids in section and solids with holes and slots. 1.3 Applications such as Tray ,Funnel, Chimney, pipe bends etc.	08
2. Auxiliary views	1. Draw the projection of objects on Auxiliary plane 2. Draw complete auxiliary view.	2.1 Auxiliary planes, Projection of object on auxiliary planes 2.2 Complete regular views with the help of given auxiliary views.	08
3. Intersection of solids	1. Visualize & draw curves of intersection of surfaces of solids	Curves of intersection of the surfaces of the solids in following cases 3.1 Prism with prism, cylinder with cylinder, prism with cylinder when i) axes are at 90° & intersect ii) The axes are at 90° & offset 3.2 Cylinder with cone when the axes of the cylinder is parallel to both the reference planes & cone resting on base on H.P. & with axis intersecting and offset from axis of cylinder.	08
4 Conventional representation	1. Draw the conventional representation.	Standard convention using SP- 46 (1988) 4.1 Materials – C.I., M.S., Brass, Bronze, Aluminum, Wood, Glass, Concrete & Rubber 4.2 Long & Short break in pipe, rod & shaft 4.3 Ball & roller bearing, pipe joints, cocks, valves, internal / external threads 4.4 Various sections – half, removed, revolved, offset, partial & aligned section 4.5 Knurling, secreted shafts, splined shafts 4.6 Springs with square & flat ends, gears, sprocket wheels & chain wheels 4.7 Countersunk & counter bore, tapers	06

5. Assembly to details	1. Visualize assembly drawing 2. Draw details from assembly drawing	5.1 Introduction – basic principles of dismantling process 5.2 Preparation of detailed working drawing of the following: i) Universal & Oldham's Coupling ii) Footstep & pedestal bearing iii) Lathe tool post, pipe vice iv) Screw jack v) Cross head vi) Gland & stuffing box vii) Steam stop valve & non return valve (Max. 8 parts)	09
6. Details to assembly	1. Visualize details of component. 2. Draw assembly drawing from given details.	6.1 Introduction – basic principles of process of assembly 6.2 Preparation of assembly drawing from the given details of components i) Universal & Oldham's Coupling ii) Footstep & pedestal bearing iii) Lathe tool post, pipe vice iv) Screw jack v) Cross head vi) Gland & stuffing box vii) Steam stop valve & non return valve (Max. 8 parts)	09
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw two problems.(01 sheet)	1. Development of surfaces of solid.	10
2.	Draw two problems.(01 sheet)	2.Auxiliary views	12
3.	Draw two problems.(01 sheet)	3.Intersection of solids	12
4.	Draw conventional representation of any ten machine elements.(01 sheet)	4 Conventional representation	06
5.	Draw details of the component from given assembly (01 sheet)	5. Assembly to details	12
6.	Draw assembly drawing from the given component in two views (01 sheet)	6.Details to assembly	12
Total Hrs.			64

Note :- Use A2 size of drawing sheets.

C. LIST OF ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw four problems for home assignment in practical sketch book.	1. Development of surfaces of solid.	-
2.	Draw four problems for home assignment in practical sketch book.	2.Auxiliary views	-
3.	Draw four problems for home assignment in practical sketch book.	3.Intersection of solids	-
4.	Draw conventional representation of machine elements.	4 Conventional representation	--
5.	Draw two problems for home assignment in practical sketch book.	5. Assembly to details	--
6	Draw two problems for home assignment in practical sketch book.	6.Details to assembly	--

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Unit	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Development of surfaces of solid.	00(00)	10(00)	00(10)	10(10)
02	Auxiliary views	00(00)	10(10)	00(00)	10(10)
03	Intersection of solids	00(00)	00(10)	10(00)	10(10)
04	Conventional Representation	12(06)	00(00)	00(00)	12(06)
05	Assembly to details	00(00)	00(00)	14(00)	14(00)
06	Details to assembly	00(00)	00(00)	14(00)	14(00)
		12(06)	20(20)	38(10)	70 (36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	U	10	1	A	10													1/2
02	2	U	10	2	U	10													1/2
03	3	A	10	3	U	10													1/2
04	4	R	3	4	R	3	4	R	3	4	R	3	4	R	3	4	R	3	4/6
05	5	A	14																1/1
06	6	A	14																1/1

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Drawing Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Practical Sketch Book	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Drawing Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Drawing Portfolio		Continuous	05	--	Drawing Portfolio	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
	Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		
End Of Course		End Of The Course	Questionnaires					

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	Nil	

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	3	3	3	–	–
2	–	3	–	–	–	–	–	3	3	3	–	–
3	–	3	–	–	–	–	–	3	3	3	–	–
4	–	3	3	3	–	–	3	3	3	3	3	–
5	–	3	3	3	–	–	3	3	3	3	3	–
6	–	3	3	3	–	–	3	3	3	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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	81-7061-091-2
2.	Engineering Drawing	N. D. Bhatt, Charotar Publishing house, 2010	978-93-80358-17-8
3.	Machine Drawing	N. D. Bhatt & V. M Panchal, Charotar Publishing house, 2010	978-93-80358-11-6
4	Mechanical Engineering Drawing	N. S. Salunke, Tech-Max Publication,	978-93-5077-209-6
5.	Machine Drawing	R. K. Dhawan , S. Chand &co.	81-219-0824-8
6.	Machine Drawing	Sidheshwar, Tata Mc Grew Hill Publication	9780074603376

❖ **E-REFERENCES:**

- <https://blogpuneet.wordpress.com/2013/11/19/wall-bracket-3d/>, assessed on 24th August 2016
- [http://www.slideshare.net/shameem.mist/engineering drawing](http://www.slideshare.net/shameem.mist/engineering-drawing), assessed on 24th August 2016
- <https://india.oup.com/orcs/9780198070771/>, assessed on 24th August 2016
<https://www.youtube.com/watch?v=jAqTQdE-mpE>,

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 1) Drawing Board with drawing instruments
- 2) Minidrafter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. O. V. Sarode	I/C HOD, Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. M. G. Thote	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. G. H. Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Mr. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/PK
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME403E ^s
COURSE TITLE	: THEORY OF MACHINES
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 03; TU: 00; PR: 02
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE.	: 03 Hrs.
PR. TEE.	: 02 Hrs. (External)
PT	: 01 Hrs.

❖ RATIONALE:

This course is classified under professional courses. Mechanical engineering technicians primarily work as production, maintenance and design supervisors. In order to perform such jobs they should have ability to analyze, identify and interpret various mechanisms and the machines. Operation and maintenance of machines need detail information of relative motions and the functional aspect of mechanism used in the machinery and the forces and couples on the members of the machine due to external forces. The course imparts the facts, concepts, principles, procedure, kinematics analysis of mechanisms, cams, power transmission device, flywheel and governor, brake and dynamometer, bearing, clutches, etc. Detail knowledge of above mentioned aspects with deep insight to the practical applications develop a professional confidence in them to become successful engineers.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply suitable mechanisms, velocity and acceleration in mechanism and drives for particular application.
2. Analyze cams and follower, flywheel and governor and graphically and analytically counterbalance mass.
3. Recognize various components of brakes and dynamometer, power transmission devices, clutches and bearings
4. Construct cam profile, displacement, velocity and acceleration diagram.
5. Calculate various terms related to open belt drive and adapt Grashof's law for four bar mechanism.
6. Operate centrifugal governor, belt drives and different mechanisms, determine graphically and analytically counterbalance mass.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Kinematics and Mechanisms.	1. Define various definitions related to kinematics and mechanisms. 2. List types of terms related to kinematics and mechanisms. 3. State types of inversions of mechanisms. 4. Draw the sketches of mechanisms and inversions. 5. Describe different mechanisms and inversions. 6. State uses of different mechanisms.	1.1 Kinematics of Machines: Definitions of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic pairs with it's types, Constrained motion and it's type, Kinematic chain with classification, Mechanism, Gruebler's criterion, Inversion, Machine and structure. 1.2 Inversions of Kinematic Chain: Inversion of four bar chain: Coupled wheels of Locomotive and Pantograph. Inversion of Single Slider Crank chain: Rotary I.C. Engines mechanism, Whitworth quick return mechanism and Crank and slotted lever quick return mechanism. Inversion of Double Slider Crank Chain: Scotch Yoke Mechanism and Oldham's Coupling. 1.3 Common mechanisms: a) Ackerman's steering mechanism b) Differential gear mechanism.	08
2. Velocity and Acceleration in Mechanisms.	1. Define terms related to velocity and acceleration. 2. State the concept of relative velocity and acceleration. 3. Calculate velocity and acceleration for given mechanism. 4. Draw velocity and acceleration diagram for given mechanism.	2.1 Definition of Linear displacement, Angular displacement. 2.2 Concept of relative velocity and relative acceleration of a point on link, Angular velocity and angular acceleration, Inter relation between linear and angular velocity and acceleration. 2.3 Drawing of velocity and acceleration diagrams of given configuration. Numericals on determination of velocity and acceleration of a point on link by relative velocity method (excluding Coriolis component of acceleration). 2.4 Determine velocity and acceleration of different links in reciprocating engine mechanism by Analytical method (No derivation) and Klein's construction.	08

3. Cams and Follower	1. Define terms related to cam. 2. Classify cams and follower. 3. Construct displacement diagram and cam profiles for the given type of follower motion with and without offset.	3.1 Definition of Cams and followers with their detailed classification and applications, Cam terminology. 3.2 Displacement diagram when the follower moves with (i) Uniform Velocity (ii) S.H.M. (iii) Uniform acceleration and retardation. Simple numerical on construction of Radial cam profiles with Knife-edge and Roller followers with and without offset.	08
4. Flywheel and Governors	1. Define Flywheel and governor. 2. Compare flywheel and governor. 3. State terms related to the governor. 4. Describe with neat sketch types of governors. 5. Select type of governor for particular application.	4.1 Flywheel: Definition, Function and Applications of flywheel, Turning moment diagram for four stroke single cylinder I. C. Engine. (No numericals), Define Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance. (No numericals). 4.2 Governors: Definition, Function and applications, its comparison with flywheel. Types of governor: a) Inertia governors. b) Centrifugal governors. i) Porter governor ii) Proell governor iii) Hartnell governor iv) Hartung governor v) Wilson-Hartnell governor. Governor terminology . (No numericals).	06
5. Power Transmission , Balancing and Vibration	1. Classify power transmission drives. 2. Select suitable power transmission drive for particular applications. 3. Compare different types of power transmission drives. 4. Calculate various parameters in belt drive. 5. State concept of balancing. 6. Find balancing mass and position of plane.	5.1 Power transmission: Types of Drives – Belt, Chain, Rope, Gear drives and their comparison. Belt Drives: i) Flat belt, V– belt and their applications, material for Flat and V-belt. ii) Terms used for belt drive : Angle of lap, Belt length, Slip and creep, velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (No derivation, Simple numericals). Chain Drives : Advantages and disadvantages, classification of chain. Gear Drive: Gear terminology,	08

		types of gears and gear trains, and their selection for different applications. Train value for simple, compound and epicyclic gear train. (No numericals.) Rope Drives: Types, applications, advantages and limitations of rope drives. 5.2 Balancing: Concept of balancing, Balancing of single rotating mass, Balancing of several masses rotating in the same plane, Analytical and graphical Methods.(Simple numerical.) 5.3 Vibration: Concept, terminology, causes.	
6. Clutches, Bearings, Brakes And Dynamometer.	1. Define clutches, bearing, brakes and dynamometers. 2. Describe construction and working of various types of clutches, bearing, brakes and dynamometers. 3. Select clutches, bearing, brakes and dynamometers for particular applications. 4. Calculate torque required to overcome friction and power lost in friction in clutches and bearings. 5. Compare between brakes and dynamometers 6. Calculate terms related to brake.	6.1 Clutches: Definition, classification and applications of clutch, Power transmission through friction by uniform pressure and uniform wear theories, Construction and working of Single plate, Multiplate, Centrifugal and Cone clutch (No derivation, simple numericals on Single and Multiplate clutches.) 6.2 Bearings : Definition, Details of Simple pivot , Collar and Conical pivot bearing. (No derivation). Calculation of torque and power lost in friction. 6.3 Brakes: Definition, Classification of Brakes, Introduction to Disc brake, Construction and working of Block brake, Band brake , Combined band and block brake, Internal expanding shoe brake (No derivation,) Find braking force , braking torque and power. 6.4 Dynamometer: Definition , Construction and working of : (i) Prony brake dynamometer. (ii) Rope brake dynamometer. (iii) Hydraulic dynamometer. (iv) Eddy current Dynamometer (No numericals).	10
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify links, types of links, kinematic chain, in following mechanisms. 1) Ackerman's steering mechanism 2) Coupling rod of locomotive. 3) Oldham's coupling. 4) Elliptical Trammel. 5) Geneva mechanism 6) Water hand pumps mechanism. Prepare proportionate sketches of above mechanisms.	Introduction To Kinematics and Mechanism	04
2	Use Grashof's law for identifying four bar mechanism.	Introduction To Kinematics and Mechanism	02
3	Determine velocity and acceleration of various links of the given two mechanisms, by relative velocity method for analysis of motion of links. (Two Problems on A2 size sheet).	Velocity and Acceleration In Mechanisms	04
4	Determine velocity and acceleration in an I.C. engine's slider crank mechanism by Klein's construction.(One Problem with varying crank angle on A2 size sheet).	Velocity and Acceleration In Mechanisms	04
5	Construct Displacement diagram Cam profile of a radial cam for the given follower type and given motion of follower with offset and without offset. (Four Problems on A2 size sheet).	Cams and Follower	04
6	Identify and locate various components of Centrifugal Governor.	Flywheel and Governors	04
7	Calculate slip, length of belt, angle of contact in an open belt drive .	Power Transmission and Balancing	04
8	Determine graphically and analytically counterbalance mass and its direction for complete balancing of a system of several masses rotating in a single plane.(Two problems on A2 size sheet).	Power Transmission and Balancing	04
Skill Assessment			02
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction To Kinematics and Mechanism	04(00)	06(00)	00(06)	10(06)
2	Velocity and Acceleration In Mechanisms	02(00)	04(04)	06(04)	12(08)
3	Cams and Follower	02(00)	04(00)	06(06)	12(06)
4	Flywheel and Governors	00(02)	06(04)	04(00)	10(06)
5	Power Transmission and Balancing	00(00)	06(06)	06(00)	12(06)
6	Clutches, Bearings, Brakes and Dynamometers.	02(04)	08(04)	04(00)	14(08)
Total		10(06)	34(18)	26(16)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	U	2	2	R	2	3	R	2	4	U	2	6	R	2	5	U	2	5/7
	4	R	2																
02	1	U	4	1	R	4	2	U	4	2	U	4	6	R	4				3/5
03	3	U	4	4	U	4	5	U	4	4	U	4	6	U	4				3/5
04	4	A	4	6	U	4	6	A	4	2	A	4	6	U	4				3/5
05	3	A	6	5	U	6	1	A	6										2/3
06	2	A	6	5	A	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing diagrams of mechanisms, governors ,cam profile , selection of equipment's. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawings (if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	3	–	–	–	–	–	–	3	–
2	–	3	–	3	–	–	–	–	–	–	3	–
3	–	3	–	3	–	–	–	–	–	–	3	–
4	–	3	2	3	–	–	–	2	–	2	3	–
5	–	3	2	3	–	–	–	2	–	2	3	–
6	–	3	2	3	–	–	–	2	–	2	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE and TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Theory of Machines and Mechanism.	Shigley, Joseph E., Uicker, John Joseph, McGraw-Hill Companies, 2 nd Edition 1994	13: 9780070569300
2.	Theory of Machines.	R.S. Khurmi and J.K. Gupta, S Chand and company ltd. 14 th Edition, 2005	10:812192524X
3.	Theory of Machines.	S.S. Ratan , Tata McGraw-Hill Education Pvt. Ltd. 3 rd Edition, 2009	13: 9780070144774

❖ **E-REFERENCES:**

- [https://en.wikipedia.org/wiki/Mechanism_\(engineering\)](https://en.wikipedia.org/wiki/Mechanism_(engineering)) , assessed on 29th July, 2016
- <http://royalmechanicalbuzz.blogspot.in/2015/04/theory-of-machines-by-rs-khurmi-ebook-pdf.html> assessed on 29th July, 2016
- <http://nptel.ac.in/video.php?subjectId=112104121> assessed on 3rd October, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Model of
 - i) Ackerman's steering mechanism
 - ii) Coupling rod of locomotive.
 - iii) Oldham's coupling.
 - iv) Elliptical Trammel.
 - v) Geneva mechanism
 - vi) Water hand pumps mechanism.
 - vii) Scotch Yoke Mechanism
- Models of Different types cam and Followers- eccentric cams, tangent cams, roller and knife edge followers.
- Models of Mechanically operated two braking mechanism for wheelers.
 - i) Shoe brake
 - ii) Band Brake
 - iii) Internal expanding shoe brake
 - iv) Disc Brake
- Balancing of several masses rotating in a single plane Test rig.

❖ **LIST OF EXPERTS and TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mrs. R A Gadekar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
2.	Mr. G. H. Dahole	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
2.	Mr. D J Ghode	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
3.	Dr. V M Athawale	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
5.	Mr. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
7.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: WS401E ^s
COURSE TITLE	: MANUFACTURING PROCESSES
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 03; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 Hrs. (External)
PT.	: 01 HR

❖ RATIONALE:

Diploma technician often comes across various types of basic manufacturing processes. He /she is required to select, operate and control the appropriate processes with respect to machines, specific cutting tools, cutting fluids for specific applications in order to convert raw material into finished products as per the requirement of drawings. He /she is also required to know about latest improvements in manufacturing processes. With sound knowledge of this subject, the diploma technician will be able to handle and control practical situations more effectively and confidently.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Adopt safety practices while working on various machines.
2. Select proper heat treatment, metal joining and casting process.
3. Select cutting tools, cutting fluids and manufacturing processes for the desired output.
4. Use proper tools, equipments and machineries for specific applications.
5. Manufacture the job by selecting proper process as per given drawing.
6. Inspect the job.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Mechanics of Metal Cuttings	1. State basic elements of machining. 2. Define terms related to cutting tools. 3. Draw cutting tool diagram showing its various nomenclature 4. Describe metal cutting principles.	1.1 Basic elements of machining 1.2 Principles of metal cutting & forces involved in metal cutting, Oblique & orthogonal cutting 1.3 Chip formation, Types of chips. 1.4 Cutting tool nomenclature & tool signature, 1.5 Cutting parameters.	04
2. Cutting Fluid & Tool Materials	1. Define various terms relate to cutting fluid. 2. Classify cutting fluids. 3. Select cutting fluids for various machining operations 4. State characteristics of various tool materials. 5. State factors affecting machinability 6. Describe the procedure of tool resharpener.	2.1 Cutting Fluid: Introduction, classification of cutting fluid, solid & liquid cutting fluid, chemical coolants, Selection of cutting fluids and its application during machining operation. 2.2 Tool Material : Introduction, characteristics of tool material, types of tool material such as plain carbon steel, high carbon steel, high speed steels, carbide tools, ceramics, diamond tools, cemented oxides, abrasives & CBN etc 2.3 Tool life & tool wear, types of tool failure. Resharpener of cutting tools. 2.4 Machinability, factors affecting machinability	06
3. Metal Joining processes	1. Define various terms related to metal jointing. 2. Classify metal jointing process. 3. Describe various welding processes. 4. State various welding defects and its causes. 5. Describe the tools and equipments used in gas welding. 6. Compare soldering and brazing. 7. Select heating methods.	3.1 Fusion process, Processes of joining, 3.2 Welding processes –Types, working principle & applications: Gas welding, carbon arc welding, shielded metal arc welding, TIG welding, MIG welding, plasma arc welding, 3.3 welding defects. 3.4 Tools & equipment used in gas welding. 3.5 Introduction to soldering and brazing – Process, fillers, heating methods & applications. 3.6 Safety precautions taken while performing joining operations	10

4. Machining Operations	1. Define various terms related to machining operations. 2. Classify lathe machines. 3. Describe construction and operation of centre lathe. 4. Define various terms relate to drill. 5. Select proper drill for particular application. 6. Classify drilling machines. 7. Describe the construction and operation of various drilling machines. 8. Describe various drilling operations. 9. Describe shaping, slotting and planning machines. 10. Compare shaping, slotting and planning machines.	4.1 Lathe Machines: Introduction, classification, centre lathe and its details, Different lathe operations like facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling. Lathe accessories and its attachments. 4.2 Drilling Machine: Introduction. , twist drill nomenclature, Classification, working principle & applications of drilling machine, like portable, sensitive, upright, radial, gang, multiple spindle.etc, Automatic drillers & turret drilling machine, Cutting speed and feed different operations performed on drilling machines like drilling, reaming, boring, counter sinking, counter boring, spot facing. 4.3 Shaping, Slotting & Planning Machine: Introduction, Elements of shaping, slotting & planning machine, Working principles, classification of shaping, slotting & planning machine ,Stroke length and its adjustment. Comparison between them. 4.4 Safety precautions adopted while working on machines	12
5.Heat Treatment Of Metals	1. Define various heat treatment terms. 2. State necessity of heat treatment 3. Describe various heat treatment methods. 4. Select proper heat treatment method for particular application.	5.1 Necessity of heat treatment, common heat treatment processes, annealing, normalizing, hardening, tempering & their selection for different metals used for industrial applications 5.2 Surface hardening methods- carburizing, induction, flame hardening & their application 5.3 Safety precautions taken while performing heat treatment.	06
6. Casting process	1. Define various terms relate to pattern, mould and casting. 2. Describe the basic steps in making casting, 3. State the properties of moulding sand. 4. Describe various moulding methods.	6.1 Pattern making: Basic steps in making casting, Pattern : types, materials and allowances, tools, color coding of patterns. 6.2 Moulding: Types of moulding sands, properties of sand, moulding methods, cores and core prints, elements of gating system, bench moulding, floor moulding, pit	10

	5. Classify furnaces. 6. Describe the construction of cupola and electric arc furnace. 7. State various casting defects their causes and remedies. 8. Describe various die casting methods. 9. Justify the causes of casting defects.	moulding, machine moulding. 6.3 Casting: Furnaces: Construction and working of cupola furnace, electric arc furnace. - Methods & applications of - Centrifugal casting, shell moulding, investment casting, Casting defects - Causes & remedies. 6.4 Hot chamber and cold chamber die casting, Die casting defects - Causes & remedies. 6.5 Safety precautions taken while performing casting operation.	
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assign ment	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Perform one simple job on TIG / MIG welding setup or prepare report on visit to TIG / MIG welding shop.	Metal Joining Process	06
2	Perform one turning job on lathe containing the operations like plain turning, step turning, taper turning, grooving, knurling and chamfering.(minimum 5 operations) • Read and interpret job drawing • Raw material size – Bar dia. 40 to 50 mm, length 80 to 100 mm. • Set the tool and select the cutting parameters for machining operations • Inspect various dimensions of jobs by using measuring instruments.	Machining process	22
3	Perform one composite job containing the operations on shaper and drill machine.	Shaper machine	12
4	Prepare report on visit to heat treatment plant with respect to processes & its methodology.	Heat Treatment	06
5	Prepare one pattern as per given drawing.	Casting (Pattern making)	12
6	Prepare mould for any one given pattern	Casting (Moulding)	06
Total			64

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Mechanics of Metal Cuttings	02(00)	04(04)	00(00)	06(04)
02	Cutting Fluid & Tool Materials	06(00)	04(00)	00(06)	10(06)
03	Metal Joining processes	02(02)	04(04)	06(00)	12(06)
04	Machining Operations	02(00)	12(04)	06(06)	20(10)
05	Heat Treatment Of Metals	04(02)	06(04)	00(00)	10(06)
06	Casting process	02(04)	04(04)	06(00)	12(08)
	Total	18(08)	34(20)	18(12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	4	R	2	6	R	2	3	R	2	5/7
	5	R	2																
02	1	U	4	2	U	4	3	U	4	1	U	4	3	U	4				3/5
03	4	U	4	4	U	4	4	U	4	4	U	4	6	R	4				3/5
04	2	R	4	5	R	4	6	U	4	5	U	4	6	U	4				3/5
05	3	A	6	4	A	6	4	A	6										2/3
06	6	A	6	5	U	6	2	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics, Assessment Sheets & Job	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Job	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Job drawing, selection of equipment's. writing procedure, precautions etc.	10
2	Performance	20
3.	Skill	10
4.	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	3	-	-	1	-	-	-	-	3	3	3
2	-	3	-	-	-	-	-	-	-	3	3	3
3	-	3	-	-	-	-	-	-	-	3	3	3
4	-	3	3	3	-	-	-	3	3	3	3	3
5	-	3	3	3	-	-	-	3	3	3	3	3
6	-	3	3	3	-	-	1	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Workshop Technology (Vol. – II)	B. S. Raghuwanshi. Tata McGraw-Hill	81 -212-0269-8
2.	Workshop Technology (Vol. - II)	Hazara & Chaudhary. Media Promoters & Publishers.	0-210-98173-3
3.	Production Technology	R.K. Jain & S.C. Gupta. Khanna Publishers.	978-0534934293
4.	Manufacturing Science and Technology (Vol.-I,II & III)	Suresh Dalela. Umesh Publication	81-7611-179-1
5.	Manufacturing Processes	Begeman, Myron L. Amstead, B.H. John Wiley & Sons Inc.	0471062405
6.	Fundamental of metal cutting and machine tools	B. L. Juneja, G.S.Sekhon, Nitin New Age International Pvt Ltd Publishers, 2008	10: 8122414672 13: 978-8122414677

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=aC7c1NgA-7M>, assessed on 23rd March 2016
- <https://www.youtube.com/watch?v=is5wdVgPOkI>, assessed on 23rd March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Lathe Machine with all accessories
2. Drilling Machine pillar type with all accessories
3. Arc welding Machine with all accessories
4. TIG welding Machine with all accessories
5. Shaping Machines with all accessories
6. Fitting, welding, moulding tools and equipments as per requirement.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. R. Chaudhari	Head of Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Dr. S. W. Rajurkar	Lecturer , Mechanical Engineering	Government Polytechnic Nagpur
3.	Mr. D. C. Satdeve	Workshop Super indent,	Government Polytechnic Nagpur
4.	Mr. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME404E
COURSE TITLE	: PRODUCTION TECHNOLOGY
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 03; TU: 00; PR: 00 (CLOCK HRs.)
TOTAL CREDITS	: 03 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 01 HRs. (Objective Type Online Examination)
PR. TEE	: NIL
PT.	: 30 MINUTES (Objective Type offline Examination)

❖ RATIONALE:

Modern manufacturing industries have complex production processes. A technician entering into such field comes across various problems involving production processes, methods, planning, scheduling etc. One has to effectively use the industrial engineering techniques for increasing productivity of men, machines, equipments and materials. Therefore, knowledge of work study, plant layout - material handling, advancements in manufacturing processes to increase the output, maintenance of equipments is very essential. This course helps to impart the knowledge of techniques for increasing productivity and better Quality control.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Recognize the various techniques of product design and process planning and control.
2. Interpret the suitability and application of plant layout.
3. Select suitable jig, fixture and locator for improving productivity.
4. Interpret the various elements of Method study.
5. Interpret the various elements of Work measurement.
6. Identify the new concepts in production technology and TQM techniques.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Production System and Product Design	1. Define Productivity and its types. 2. State the requirement of proper production system. 3. Describe techniques of improving productivity. 4. Describe approach and concept of product development.	1.1 Introduction to production system 1.2 Types of production system and applications. 1.3 Requirements and Factors of good production system. 1.4 Product development approaches, Product development process and Related Concepts-Simplification, Standardization, Specialization 1.5 Definition of productivity, types, techniques of improvement of productivity.	05
2. Plant Location and Layout.	1. State importance of Site selection. 2. Identify factors affecting site selection. 3. Identify Govt. policies/relaxation related to plant location in backward area. . 4. Define plant layout and its types. 5. Compare different type of plant layout. 6. State objectives of good plant layout. 7. Enlist characteristics of good plant layout. 8. State symptoms of bad plant layout. 9. Describe design principle of plant layout.	2.1 Importance of site selection and governing factors. 2.2 Govt. policies, Relaxation for backward areas 2.3 Definition, objectives and types of plant layout. 2.4 Characteristics of good plant layout 2.5 Symptoms of bad plant layout. 2.5 Design principle of plant layout.	05
3. Process planning, jigs and fixtures.	1. Define process planning. 2. Enlist steps involved in process planning. 3. State factors affecting process planning. 4. Select sequence of operations for a process. 5. Describe need of operation sheet. 6. Define standard time, setup time and operation time for a job. 7. Prepare operation sheet for a component. 8. State the objective of confining the operations. 9. Describe need of inspection during production. 10. Describe factors for selection of stage for inspection. 11. Define jigs and fixture. 12. Differentiate jigs and fixture. 13. State application of locator. 14. Describe general principle of design of jigs and fixture.	3.1 Process planning from raw material to finish product. 3.2 Factors affecting the process planning. 3.3 Sequence of operations, operation sheet, and combined operation. 3.4 Determination of stages of inspection. 3.5 Introduction of jigs and fixture, difference between jigs and fixture. 3.6 Types of jigs and fixture. 3.7 Types of locators, 3,2,1 principle of location. 3.8 General principles of jigs and fixture design.	08
4. Production Planning and Control.	1. Define Production planning and control. 2. State importance of Production Planning and Control in	4.1 Introduction to Production Planning and Control (PPC). 4.2 Function of production planning and control.	14

	manufacturing unit. 3. State Six principle objectives of production planning and control. 4. Define Routing in manufacturing unit. 5. Express the decisions that are to be taken in routing. 6. State advantages of routing. 7. Define the term sequencing of operations. 8. Define scheduling of activities for production. 9. State advantages of scheduling. 10. Differentiate Scheduling and Routing. 11. Define Dispatching. 12. Enlist forms used in Dispatching. 13. Describe types dispatching. 14. Construct a Gantt chart for a given Sample data. 15. State advantages of Gantt chart. 16. Define line balancing. 17. Describe need of line balancing.	4.3 Routing, definition, concept and route sheet. 4.4 Sequencing N jobs on 2 machines. 4.5 Scheduling devices. 4.6 Factors affecting scheduling devices. 4.7 Definition of Dispatching. 4.8 Types and common forms used in Dispatching. 4.9 Definition of Production Control and the "Expediting". 4.10 Definition of progressive control of production and its steps. 4.11 Concept of line balancing. 4.12 Gantt chart, as control tool and method of construction. 4.13 Advantages of Gantt chart.	
5. Industrial Engineering.	1. Define Method study and work measurement. 2. State objectives of Method study and work measurement. 3. State steps in Method study and work measurement. 4. Describe different recording techniques used in method study. 5. Describe principles of motion economy.	5.1 Method study : – Terminology used, aims and objectives, steps in method study and method improvement, various recording techniques. 5.2 Outline process, flow process charts, multiple activity chart, two handed process chart and string diagram 5.3 Principles of motion economy 5.4 Work Measurement: - Definition, aims, objectives, Time study equipment, 5.5 Scientific methods of work measurement, advanced methods in work measurement, 5.6 Normal time, standard time, allowances, Merit rating. (Numerical to find out standard time)	08
6. New Concepts In Production Technology	1. Describe CAPP 2. Describe Single minute exchange of dies. 3. Describe Lean Production or lean manufacturing 4. State elements of lean production 5. Describe concept of kaizen, kanban, 5S, 3M 6. Compare traditional and Lean Production on the basis of production, layout, batch size, process, quality 7. State Benefits of Lean Production 8. Describe ISO9000 9. Describe Quality circle 10 Describe TQM 11. Describe BPR	6.1 Computer Aided Process Planning (CAPP) 6.2 Single minute exchange of dies 6.3 Lean Production or lean manufacturing- Objective, elements of lean production. 6.4 Concept of kaizen, kanban, 5S, 3M Benefits of Lean Production, Comparison between traditional and Lean Production on the basis of production, layout, batch size, process, quality 6.5 Selective Laser Melting (SLM) production system 6.6 ISO 9000, Quality circle, Total Quality Management (TQM), Business Process Re-engineering (BPR).	08
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
Nil			

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Production System and Product Design.	02(00)	04(00)	02(00)	08(00)
02	Plant Location and Layout.	04(00)	08(00)	02(00)	14(00)
03	Process planning, jigs and fixtures.	04(00)	08(00)	04(06)	16(00)
04	Production Planning and Control.	02(00)	04(00)	00(00)	16(12)
05	Industrial Engineering.	04(00)	10(04)	06(00)	20(04)
06	New Concepts In Production Technology	02(00)	02(00)	02(00)	06(00)
	Total	18(00)	36(00)	16 (00)	70 (00)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Bit 7		
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M
01 To 35	1	R	2	2	R	2	3	R	2	4	R	2	1	U	2	2	R	2	1	U	2
	3	U	2	2	A	2	1	A	2	2	U	2	3	R	2	4	U	2	2	U	2
	4	A	2	4	U	2	4	U	2	5	R	2	2	U	2	3	U	2	4	R	2
	2	U	2	3	U	2	5	R	2	4	U	2	3	U	2	5	U	2	3	A	2
	4	U	2	3	A	2	4	A	2	6	R	2	6	U	2	6	U	2	4	A	2

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Online Exam.	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	--	--	--	--
		Journal Writing		Continuous	--	--	--	--
				TOTAL	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	Nil	

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	3	–
2	–	3	–	–	–	–	–	–	–	3	3	–
3	–	3	3	3	–	–	–	3	3	3	3	–
4	–	3	3	3	–	–	2	3	3	3	3	–
5	–	3	3	3	–	–	2	3	3	3	3	–
6	–	3	–	–	–	–	–	–	–	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE and TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	A Text Book of Production Technology	P. C. Sharma, S. Chand and Co. Ltd, Delhi, 1 st Edition, 2009	81-2191-114-1
2.	Production Technology	R. K. Jain, Khanna Publisher, 17 th Edition, 2001	81-740-9099-1
3.	Production Technology	K. L. Narayana, Swarna Venkate Ramana, I.K. International Publishing House Pvt. Ltd., 2 nd Edition, 2000	978-93-80578-52-1
4.	Production Technology	Pakirappa, Durga Publishing House, 4 th Edition, 2005	13-120-5002-9
5.	Industrial Engineering and Management	T. R. Banga and S. C. Sharma, Khanna Publishers, 25 th Edition, 2014	978-81-7409-078-9

❖ **E-REFERENCES:**

- <http://link.springer.com/book/10.1007%2F978-3-319-12304-2> , assessed on 10th September, 2016
- <http://svmcollege.in/14403/rk-jain-production-technology-free-download-site/>., assessed on 10th September, 2016
- <https://docs.google.com/document/d/1Raos2OWuTZypsp8XE1dUi6FCcHOfl08PE5ojXMdFp2U/edit> , assessed on 10th September, 2016
- <http://ebookinga.com/pdf/a-textbook-of-production-engineering-by-pc-sharma-pdf-free-download> , assessed on 10th September, 2016
- <http://pec.ac.in/~pecac/new/wp-content/uploads/2015/01/Production-Industrial-engineering.pdf> assessed on 10th September, 2016
- <http://joteringstu.esy.es/advances-in-production-technology-lecture-notes-in-production-engineering.pdf> . , assessed on 10th September, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Nil

❖ **LIST OF EXPERTS and TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. A. R. Sheikh	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. M. M. Dangre	Lecturer in Mechanical Engineering	Government Polytechnic, Gadchiroli.
3.	Mr. G. H. Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Mrs. R. A. Gadekar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
5.	Mr. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
7.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME405E ^s
COURSE TITLE	: INTERNAL COMBUSTION ENGINES
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 03; TU: 00; PR: 02 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs.
PR. TEE	: 02 HRs. (External)
PT.	: 1 HR.

❖ RATIONALE:

I.C. Engines & air compressor finds applications in almost all sectors of industry due to automation and in automobile fields due to increase in transportation of goods & people day by day. Also I.C. engines are one of the major contributors of air pollution Hence it is necessary to understand constructional, working & thermodynamic features of I.C. engine as Diploma technicians deal with working, testing and maintenance of it. Therefore, Internal Combustion Engines course has been considered highly relevant for mechanical technician.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze working of IC Engine, Gas Turbine and Air compressor.
2. Interpret different system in IC Engine, Gas Turbine and Air compressor
3. Calculate the performance parameter of I C Engine and Air compressor and its effect on environment
4. Develop ability to dismantle and assemble I C Engine
5. Observe and report writing of different components of I C Engine through visit
6. Operate IC Engine and Air compressor to measure different parameters and identify faults and remedies through test and visit

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Introduction to I. C. Engine	1. List and Identify parts of engine. 2. State different application of I.C. engine 3. Define different term related to I.C. engine 4. Classify IC engine on various basis. 5. Describe the functions of various parts of IC engines. 6. Calculate Swept volume, Compression ratio, cut off ratio	1.1 Classification of I.C. engines, 1.2 Applications of I. C. engine 1.3 Different parts of I.C. engine and their functions 1.4 Basic engine terminology Bore, stroke, TDC, BDC, Clearance volume, Swept volume, Compression ratio, cut off ratio	04
2. Spark ignition engines	1. Describe working principle of S.I. engine 2. Interpret indicator and valve timing diagram 3. Calculate air standard efficiency and MEP 4. List and Identify parts of fuel supply system 5. Illustrate air fuel requirement in S.I. engine 6. Describe electronic petrol injection and electronic ignition system with sketch. 7. Describe detonation and pre-ignition 8. State concept of DTSI Engine. 9. Compare battery and magneto ignition system on various basis	2.1 Working principle of two and four stroke S.I engine .Otto cycle, air standard efficiency, mean effective pressure, effect of compression ratio on efficiency, valve timing diagram for four stroke engines. Numerical to calculate air standard efficiency, Mean Effective pressure (MEP). 2.2 Carburetion: fuel supply system, Function of carburetor, air fuel mixture and fuel requirements of S. I. engines., simple carburetor and its drawback, petrol injection system, port and throttle MPFI system, Electronic fuel injection - D-MPFI system , L-MPFI system 2.3. Ignition: Requirements for ignition, battery and magneto ignition system and comparison, concept of electronic ignition systems, transistorized assisted contact ignition system(TACIS), 2.4 Concept of digital twin spark ignition Engine. (DTSI Engine) 2.5 Concepts of pre-ignition and detonation.	12

3 Compression Ignition Engine	1. Describe working principal of C.I. engine 2. Draw P-V and T-S diagram of diesel cycle 3. Interpret valve timing diagram with working of diesel engine 4. Calculate air standard efficiency of diesel cycle. 5. State function of fuel injection system and working of fuel pump and injector 6. Describe concept of CRDI system and electronic ignition system 7. Justify the use of supercharging and turbo charging in I.C. engine 8. Compare S.I. and C.I. engine on various basis	3.1 Working principle of Two and four stroke C.I. engine .Diesel cycle, air standard efficiency, valve timing diagram for four stroke engines. Numerical to calculate air standard efficiency, No derivation) 3.2 Fuel injection: function of fuel injection system, types of fuel injection systems, working of fuel injector, fuel pump -bosh type only, CRDI concept, need of electronic injection system 3.3 Concept, advantages and applications of supercharging and turbo-charging 3.4 Comparison between S.I. and C.I. engine 3.5 Comparison between two stroke and four stroke engine.	10
4 Cooling and lubrication	1. State types of cooling method and its application 2. State types of lubricating methods and its application 3. Compare different cooling system 4. State lubricant additives and its function 5. Describe lubrication system with sketch 6. Describe cooling system with sketch	4.1 Cooling: -Need of cooling of an I. C. engine, Types of cooling system, Air cooling, its applications and advantages. Water /liquid cooling(natural and forced circulation of water),application, advantages and comparison With air cooling. Different types of coolants. 4.2 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 4.3 Lubricant additives and their function	06
5 I.C. engine testing and pollution	1. Define I.C. engine testing terminology 2. Calculate power and efficiency. 3. Draw heat balance sheet 4. State pollutants in exhaust gases of I.C. engine and its effect on environment 5. State the norms of pollution 6. Describe catalytic converter	5.1 Need of testing of an I.C. engine. Engine power, I.P, B.P compression ratio. Mechanical efficiency. heat balance sheet ,Morse test, Numerical to calculate I.P. ,B. P., Mechanical efficiency and heat balance sheet. 5.2 Pollutants in exhaust gases of petrol and diesel engines, their effects on environment, Catalytic Converter, Bharat stage III, IV norms.	08

6 Introduction to gas turbine and air compressor	- Describe the working of gas turbine - Compare close cycle and open cycle gas turbine - State uses of compressed air - Define air compressor terminology - Calculate power required and efficiencies of compressor - Interpret multistage of compressor and concept of Inter cooling and after cooling - Analyze P-V diagram with inter cooling.	6.1 Introduction to gas turbines Classification and applications of gas turbine, working of Constant pressure Closed cycle and open cycle gas turbines and their comparison. 6.2 Introduction to air compressor Uses of compressed air, classification. Definition of Pressure ratio, capacity, F.A.D Swept volume 6.3 Reciprocating air compressor Construction and working of single and two stage compressors. Volumetric, Isothermal and Mechanical efficiency. Advantages of multi-staging, concept of Inter cooling and after cooling. Numerical to calculate mechanical and isothermal efficiency, power required. (No derivation)	08
		Total Hrs	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Locate and identify various I.C. engine parts and draw its neat sketches	Introduction to I.C. engine	2
2	Dismantle & assemble (a) Simple carburetor (b) Fuel injection pump (bosch type)	S.I. & C. I. engine	4
3	Dismantle & assemble four stroke CI engine and identify the various components	C.I. engine	4
4	Locate and identify components of cooling & lubrication system and draw its neat sketches	Cooling & lubrication of I. C. engine	2
5	Conduct test on I.C. engine to prepare heat balance sheet	I.C. engine testing and pollution	4
6	Conduct Morse Test on multi cylinder petrol engine to determine its indicated power and mechanical efficiency.	I.C. engine testing and pollution	4
7	Conduct test on two-stage reciprocating air compressor to determine its volumetric efficiency	Introduction to air compressor & gas turbine	4
8	Prepare a report on visit to engine maintenance workshop.	All Units	6
Skill Assessment			02
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to I. C. Engine	02(04)	04(00)	00(00)	06(04)
02	Spark Ignition engines	04(00)	08(06)	06(00)	18(06)
03	Compression Ignition engine	02(00)	04(04)	06(04)	12(08)
04	Cooling & lubrication	02(02)	08(04)	00(00)	10(06)
05	I.C. engine testing & pollution	02(00)	04(06)	06(04)	12(10)
06	Introduction to gas turbine & air compressor	02(02)	04(04)	06(00)	12(06)
	Total	14(08)	32 (24)	24 (08)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	3	R	2	4	R	2	5	R	2	6	R	2	4	R	2	5/7
	6	R	2																
02	1	U	4	2	U	4	3	U	4	4	U	4	5	A	4				3/5
03	2	R	4	4	U	4	5	U	4	6	U	4	3	A	4				3/5
04	2	U	4	4	U	4	6	U	4	1	R	4	3	U	4				3/5
05	2	A	6	5	A	6	2	U	6										2/3
06	3	A	6	6	A	6	5	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S. N.	Description	Max. Marks
1	Drawing diagrams of various parts of IC engines, selection of equipment's. & tools, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	3	–	–	–
2	–	3	–	–	–	–	–	–	3	–	–	–
3	–	3	3	3	–	1	–	3	–	3	3	–
4	–	3	3	3	–	–	2	3	–	3	3	–
5	–	3	3	3	–	–	2	3	3	3	3	–
6	–	3	3	3	–	–	2	3	–	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE AND TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Internal Combustion Engine	R. P. Sharma, Dhanpat Rai Publication , 2010	9788189928469
2.	A Course in Internal Combustion Engine (SI Units)	V.M. Domkundwar, Dhanpat Rai & Co. Ltd. Publication, Fourth edition, 2014	978-81-7700-116-7
3	Internal Combustion Engine	V. Ganeshan, Mcgraw Hill Education, 4 th Edition, 2012	13-9781259006197 10-1259006190
4	Internal Combustion Engine	H. B. Keswani, Standard Book , 4 th Edition 2003	81900893511

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=pqa4zCo4erY> , assessed on 23rd August, 2016
- <https://www.youtube.com/watch?v=s2WGFELXPNg> assessed on 23rd August, 2016
- automobiletechinfo.blogspot.com/.../dtsi-digital-twin-spark-ignition-system.html assessed on 23rd August, 2016
- <https://www.youtube.com/watch?v=H2J0ISTYVhQ> assessed on 23rd August, 2016
- <https://www.youtube.com/watch?v=H2J0ISTYVhQ> assessed on 23rd August, 2016
- www.cpcb.nic.in/Vehicular_Exhaust.php assessed on 23rd August, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Test rig of four stroke diesel engine
- Test Rig of Two stage reciprocating compressor
- Working .Model of fuel pump ,injector & carburetor
- Working model of C.I. engine
- Demonstration Model & chart of cooling , lubrication & fuel supply system of I. C. engine.

❖ **LIST OF EXPERTS and TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. O. V. Sarode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. S. A. Dhankute	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. A. R. Sheikh	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4	Mr. M. M. Dangare	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
5.	Mr. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
7.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

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GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : ME406E^s

COURSE TITLE : FLUID POWER

PREREQUISITE : NIL

TEACHING SCHEME : TH: 03; TU: 00; PR: 02(CLOCK HRs.)

TOTAL CREDITS : 04(3 TH/TU CREDIT = 3 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)

TH. TEE : 03 HRs

PR. TEE : 02 HRs (External)

PT. : 01HR

❖ **RATIONALE:**

Fluid Power is a classical subject. This course introduce Fluid Mechanics and establish its relevance in Mechanical Engineering .It deals with fundamental concepts and principles in hydraulics, hydro kinematics and hydrodynamics and their application in solving fluid flow problems.

In India about 22% (42, 783.43 MW; 30 June, 2016) Electric Energy is generated by Hydroelectric Power plant. Hydraulic Turbine plays a vital role in this area. Hydraulic pumps have important role in water supply, irrigation etc. This course describes Hydraulic machines and evaluates its power and efficiency.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply fundamental concepts and Bernoulli's Equation for various applications on fluid flow.
2. Apply principles of Fluid Machine's and recommend it for particular application.
3. Analyze the input energy Kinetic and total energy on fluid blades to obtain its power and efficiency.
4. Measure characteristics like pressure, velocity, flow rate , etc by using flow and pressure measuring device
5. Operate various hydraulic machines and interpret its result.
6. Perform various operations on Centrifugal and Reciprocating pump.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Fundamentals of Fluid and Fluid Static	1. Define various terms related to properties of fluid. 2. Define terms related to pressure 3. Describe the process of using different Manometers and pressure Gauge to measure pressure of liquid in pipes. 4. Calculate pressure in manometers. 5. Differentiate various manometers. 6. Describe Bourdon Tube Pressure Gauge. 7. Calculate total pressure and centre of pressure on plane surface submerged in liquid.	1.1 Mass Density, Specific Weight, Specific volume, Specific gravity, Dynamic viscosity, Kinematic viscosity. Newtonian and non-Newtonian Fluid. Units and dimensions of all properties. (Numerical Problem based on it.) 1.2 Compressibility, Surface tension, Capillarity, Vapour Pressure and Cavitations. 1.3 Fluid pressure at a point, Pascal's Law, Pressure head, Pressure intensity. 1.4 Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure. 1.5 Manometer. Simple Manometer- Piezometer and U-tube Manometer, Differential Manometer- U-tube, Differential Manometer and Inverted Differential Manometer, Bourdon Tube Pressure Gauge. (Numerical based on it.) 1.6 Total Pressure and Centre of Pressure 1.7 Total Pressure and Centre of pressure on Horizontal, Vertical and Inclined Plane surface. Calculate pressure of liquid on submerged body. (Numerical based on it.) No derivation on Inclined plane surface, only formula.	07
2 Fundamentals of Fluid Flow	1. Define types of fluid flow. 2. Identify laminar and turbulent flow of flowing fluid 3. Correlate various energies in flowing fluid. 4. Apply continuity equation to calculate velocity and discharge of liquid	2.1 Kinematics: - Types of fluid flows- steady, unsteady, uniform, non uniform, rotational, irrotational, Laminar, turbulent, Compressible and Incompressible flow. 2.2 Description of Flow Pattern – Streamline and Stream tube, Continuity equation, Rate of flow or discharge.	07

	5. State restrictions of Bernoulli's theorem. 6. Apply Bernoulli's theorem on Venturimeter, Orifice plate, Pitot tube. 7. Calculate discharge of liquid. 8. Calculate discharge and Hydraulic Coefficient. 9. Determine hydraulic coefficients.	2.3 Dynamics:- Energy possessed by flowing fluid- Kinetic energy, Potential Energy and Pressure Energy. Bernoulli's theorem- Its application on Venturi meter, orifice meter and Pitot tube. (Numerical based on it.) 2.4 Orifice- Classification, Flow through orifice and Experimental determination of Hydraulic Coefficient .Calculate discharge and Hydraulic Coefficient.	
3. Flow Through Pipes	1. State laws of friction for laminar and turbulent flow. 2. Calculate Major and minor losses in pipes. 3. Describe total gradient and hydraulic gradient discharging freely in atmosphere. 4. Determine Maximum power transmission through a pipe. 5. Describe water hammer in pipes.	3.1 Laws of fluid friction - Laminar and turbulent. 3.2 Darcy's- Weibach equation and Chezy's equation for frictional losses in pipes. No Derivation. Calculate major loss in pipe. 3.3 Minor losses in fittings and valves. Calculate minor loss (Numerical based on it.) 3.4 Hydraulic gradient line and total energy line 3.5 Flow through pipe in series or Compound pipes. 3.6 Hydraulic power transmission through pipe 3.7 Water Hammer in Pipes.	06
4. Impact of Jets	1. Define impact of jet. 2. Determine impact of jet on Stationary and moving plates and curved vanes. 3. Draw velocity triangle diagram at inlet and outlet on plates and curved vanes. 4. Calculate work done and efficiency.	4.1 Impact of free jet, Impulse momentum equation, Impact of jet on Stationary and Moving Vertical, Inclined Flat Plate. 4.2 Impact of jet on Stationary and Moving Curved plate at the centre. Calculate force 4.3 Impact of jet on Stationary and Moving symmetrical and unsymmetrical curved one end tangentially when the plate is symmetrical and unsymmetrical. (Numerical based on it.) (No Derivation. Only Formulae related to Work done, efficiency and Velocity triangle at inlet and outlet Diagram.)	04
5 Hydraulic Turbines	1. Draw general layout of hydroelectric power plant. 2. Identify Hydraulics turbine according to its classifications.	5.1 Layout and features of hydroelectric power plant, surge tanks and its need. 5.2 Head and efficiency's hydraulic turbines	12

	3. Describe various Component and working of hydraulic turbines. 4. Select of hydraulic turbines according to available head. 5. Compare hydraulic turbines on the basis of various parameters. 6. List function of draft tube in hydraulic turbines. 7. Calculate work done and efficiency.	5.2 Classification of hydraulic turbines and their applications. 5.3 Component, Construction and Working principle of Pelton wheel, Francis, Propeller and Kaplan turbine. Governing of turbine. 5.4 Draft tubes – types, construction and function. 5.5 Calculation of Work done Power, and efficiency of turbine. (Numerical based on it.) 5.6 Concept of Cavitation in turbines, 5.7 Selection of Hydraulic Turbine. 5.8 Specific speed of turbine	
6. Pumps	1. Describe working of Centrifugal pump, multistage pumps and reciprocating pumps 2. Compute Manometric head, Work done, Manometric efficiency, and Overall efficiency of centrifugal pump. 3. Describe Submersible pumps and jet pump. 4. Analyze importance of air vessels in reciprocating pumps. 5. Draw indicator diagram of reciprocating pump. 6. Find various heads, Efficiencies, Diameters of impellor, various velocities, Inlet and outlet Vane angle. θ, ϕ, α and β as indicated in velocity triangle, Discharge of pump and Work done by impellor.	6.1 Centrifugal Pump: -Classification, Construction, principle of working, priming methods. 6.2 Types of casings and impellers. 6.3 Manometric head, Work done, Manometric efficiency, Overall efficiency, Net Positive Suction Head (NPSH), Priming of a centrifugal pump. 6.4 Operating Characteristics of Centrifugal pumps. 6.5 Pumps in series and parallel. 6.7 Submersible pumps and jet pump. Find various heads, Efficiencies, Diameters of impellor, Various velocities, Inlet and outlet Vane angle. θ, ϕ, α and β as indicated in velocity triangle, Discharge of pump and Work done by impellor. 6.8 Reciprocating Pump: - Construction, working principle and applications of single and double acting reciprocating pumps. 6.9 Slip, Cavitation and separation. 6.10 Use of Air Vessels. 6.11 Indicator diagram with effect of acceleration head and frictional head. (Numerical based on Centrifugal pump & Reciprocating Pump)	12
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Determine the sum of pressure energy, kinetic energy and potential energy at each section of conduit is constant and prove Bernoulli's Theorem.	Fundamentals of Fluid Flow	2
2	Determine coefficient of discharge for Venturimeter		4
3	Determine coefficient of discharge for Orifice Meter.		2
4	Determine Coefficient of Discharge, Coefficient of Contraction and Coefficient of Velocity of Sharp edged circular orifice		2
5	Determine Dracy's friction factor in pipes of three different materials.	Flow Through Pipes	2
6	Determine minor friction loss for flow in pipes (bends, fittings, etc)		4
7	Determine overall efficiency of Pelton Turbine.	Hydraulic Turbines	4
8	Determine overall efficiency of Francis Turbine		4
9	Determine overall efficiency of Centrifugal Pump.	Pumps	4
10	Determine overall efficiency of Reciprocating Pump.		2
Skill Assessment			2
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Fundamentals of Fluid and Fluid Static	02(02)	08(04)	00(00)	10(06)
02	Fundamentals of Fluid Flow	06(02)	04(00)	00(04)	10(06)
03	Flow Through Pipes	04(00)	04(00)	00(04)	08(04)
04	Impact of Jets	02(00)	04(04)	00(00)	06(04)
05	Hydraulic Turbines	02(00)	04(06)	12(04)	18(10)
06	Pumps	02(04)	10(06)	06(00)	18(10)
	Total	18(08)	34(20)	18 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	4	R	2	5	R	2	6	R	2	1	R	2	5/7
	2	R	2																
02	1	U	4	1	U	4	2	R	4	1	U	4	2	A	4				3/5
03	2	U	4	3	R	4	3	U	4	3	A	4	4	U	4				3/5
04	4	U	4	5	U	4	6	U	4	5	A	4	6	R	4				3/5
05	5	A	6	5	A	6	5	U	6										2/3
06	6	A	6	6	U	6	6	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of equipment's, Drawing sketch of Apparatus, Writing procedure, Observation Tables.etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	3	-	-	-	-	-	-	3	3	3	-
2	-	3	-	-	-	-	-	-	3	3	3	-
3	-	3	-	-	-	-	-	-	3	3	3	-
4	-	3	2	2	-	-	-	2	3	3	3	-
5	-	3	2	2	-	-	-	2	3	3	3	-
6	-	3	2	2	-	-	-	2	3	3	3	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE AND TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas, S. Chakraborty, Tata Mc- Graw Hill Education Private Limited, Third Edition, 2016	13: 978-0-071329194 10: 07-132919-6
2.	A Text Book of Fluid Mechanics and Hydraulic Machines	R. K. Bansal, Laxmi Publication (P) ltd, Ninth Edition, 2013.	13: 9788170083115
3.	Hydraulics and Fluid Mechanics including Hydraulic Machines	P. N. Modi and S. M. Seth, Standard Book house, Twentieth Edition, 2015,	81-900893-7-4 078-81-898401-26-9
4.	Hydraulic Machines	Dr. Jagdish Lal, Metropolitan Book Co. Pvt Ltd., 1994	978-81-224-1042-6
5.	Fluid Mechanics	F. M White, McGraw-Hill College; Sixth Edition, October, 2006.	10: 0072938447 13: 978-0072938449

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/112105171/1> , assessed on 05th September, 2016
- <http://msubbu.in/ln/fm/> , assessed on 05th September, 2016
- http://www.engineeringtoolbox.com/fluid-mechanics-t_21.html , assessed on 05th September, 2016
- http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/Course_home-lec28.htm , assessed on 05th September, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Piezometer, Differential U-tube Manometer, Bourdon Pressure Gauge, Measuring tank and stop watch
2. Hydraulic Bench containing Piezometer, scale, measuring cylinder, stop watch etc.
3. Test Rig of flow through pipes, and various bends, pipe fitting etc.
4. Pelton Wheel Test Rig.
5. Francis Turbine Test Rig with Dynamometer.
6. Centrifugal pump Test Rig.
7. Reciprocating Pumps Test Rig.

❖ **LIST OF EXPERTS AND TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. P. P. Patil	Lecturer , Department of Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. A. R. Sheikh.	Lecturer , Department of Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. S. A. Dhankute.	Lecturer , Department of Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A. M. Onkar	Chief Executive Officer	OnkarFurnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: WS402E
COURSE TITLE	: ADVANCE MANUFACTURING PROCESSES
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 03; TU: 00; PR: 02 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

❖ RATIONALE:

This is a advanced technology subject which is to be taught, after getting conversant with the basic manufacturing processes. It is necessary for a diploma engineer to know about the advancements in the area of manufacturing processes. This subject will impart knowledge & skills necessary for working in modern manufacturing environment. This subject will help the student to get familiarize with working principles and operations performed on non conventional machines, advanced welding techniques, milling machines, grinding machines, surface finishing machines and maintenance of machine tools.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Adopt safety practices while working on various machines.
2. Apply fundamental concepts of different Non-traditional machining processes for given situation.
3. Apply modern trends in manufacturing and automation.
4. Perform jobs as per drawing by selecting appropriate machining process.
5. Prepare report by visiting various manufacturing shops/industries.
6. Prepare maintenance schedule for various manufacturing machines..

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Traditional Machining Methods	1. Define various terms related to traditional machining processes. 2. Classify Broaching machines. 3. Describe construction, operation & application of horizontal broaching machine. 4. Describe Capstain, Turret lathe, automats. 5. Describe construction, operation & application of Plano miller 6. Classify Boring machines. 7. Describe boring tools & operations. 8. Select proper machining process for performing operations.	1.1 Broaching machines:- Introduction, classification of Broaching machines, basic parts of horizontal broaching machine & their functions, applications, advantages and limitations of Broaching machine. 1.2 Capstan, turret lathe & automats, Planer and plan miller function of parts & operations. 1.3 Boring Machines – types, tools and operations.	08
2. Non-traditional Material removal processes	1. State necessity of non-traditional material removal processes. 2. Classify non-traditional material removal processes. 3. Describe various non-traditional material removal processes. 4. State the advantages, disadvantages and applications of various non-traditional material removal processes. 5. Select proper machining process for performing operations.	2.1 Need, mechanisms & process parameter in Material removal process (MRP), Classification of MRP 2.2 Abrasive jet machining (AJM), Water jet machining (WJM), Electric discharge machining (EDM), wire cut Electric discharge machining (WEDM), Laser beam machining (LBM), Electro chemical machining (ECM), Ultrasonic machining (USM) - setup, working principle, process parameters, advantages, disadvantages and applications of all above processes.	10
3. Milling & Gear Cutting operation	1. Define various terms related to milling operations 2. Classify Milling machines 3. State basic parts of Milling machines. 4. Describe milling cutters. 5. Describe milling operations. 6. Describe cutting parameters of milling machines. 7. Classify gear manufacturing methods 8. Describe various gear	3.1 Milling: Introduction, classification, basic parts of column & knee type milling machine & their functions, milling cutters, different milling operations, like plain milling, side milling, straddle milling, gang milling, face milling - slot milling, slitting. Up milling & down milling, cutting parameters of milling operations. 3.2 Gear Cutting: Introduction, gear manufacturing methods, universal	08

	manufacturing processes. 9. State advantages, disadvantages & applications of gear manufacturing processes 10. Describe universal dividing head & indexing methods. 11. Describe various gear finishing methods. 12. Select proper machining process for performing operations on milling machines.	dividing head & indexing methods, gear shaping & gear hobbing - setup, working, advantages, disadvantages, applications, gear finishing methods- grinding, shaving, burnishing.	
4. Surface Finishing processes	1. Classify grinding machines. 2. State designation and specifications of grinding wheels 3. Describe working of grinding machines 4. Select proper grinding wheel for particular applications 5. Describe wheel dressing, truing & balancing processes. 6. Describe super finishing processes like honing, lapping, burnishing, polishing & buffing. 7. State advantages, disadvantages of super finishing processes 8. Select proper super finishing processes for particular applications	4.1 Grinding Machines: Classification and working of grinding machine - surface, cylindrical, centreless, grinding wheel specifications, grinding wheel dressing & truing. Selection criteria for grinding wheel. Balancing of grinding wheels, safety precautions. 4.2 Super Finishing: Methods of surface finishing like honing, lapping, burnishing, polishing and buffing - setup, working, advantages, limitations and applications	08
5 Advanced welding & other Processes	1. Describe submerged arc welding process 2. Describe resistance arc welding process 3. Describe solid state welding process 4. Describe laser beam welding process 5. State advantages, disadvantages of advanced welding processes 9. Select proper welding processes for particular applications 6. Describe hybrid manufacturing processes. 7. State application of hybrid manufacturing process 8. Describe rapid prototyping technology and state its	5.1 Introduction, Submerged arc welding process, resistance welding process, Solid state welding process, Laser beam welding process- basic principle, advantages, disadvantages & applications of each process. 5.2 Hybrid Manufacturing processes, Rapid prototyping technology- Introduction, working principle & application.	10

	application		
6. Maintenance of Machine Tools:	1. State the need of maintenance activity. 2. Classify maintenance practices 3. Describe maintenance practices of various machine tools. 4. Describe maintenance cycle and repair complexity 5. Describe the details of maintenance manual 6. State the importance of maintenance records.	6.1 Need and importance of maintenance activity, Types of maintenance, Basic maintenance practices for simple machine elements, viz Bearing, Coupling, Shaft and pulley, gears, chains, machine belts. 6.2 Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records.	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assign ment	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Prepare report on visit to fabrication shop regarding actual working of Broaching machine, Boring machine, Planer machine and their applications.	Traditional Machining Methods	04
2	Prepare report on Industrial visit to nontraditional machining process with respect to its working principle & parameters.	Non- traditional Material removal processes	06
3	Perform gear cutting (spur gear /helical gear) operation by using simple indexing method (max. four students per job).	Milling & Gear Cutting operation	08
4	Perform surface grinding / cylindrical grinding operation on job for given diagram. (max. four students per job).	Surface Finishing processes	04
5	Prepare power point presentation on Non-traditional manufacturing process/advanced welding techniques (2 students/ group) & present in practical batch.	Advanced welding & other Processes	06
6	Prepare Maintenance report for any two machines/machine elements with reference to type of faults, causes & remedies. (In a group of 4-5 students)	Maintenance of Machine Tools	04
Note: - Workshop diary should be maintained by each student duly signed by respective shop instructors.			
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Traditional Machining Methods	02 (04)	04 (04)	06 (00)	12 (08)
02	Non- traditional Material removal processes	00 (02)	08 (08)	06 (00)	14 (10)
03	Milling & Gear Cutting operation	04 (00)	08 (00)	00 (06)	12 (06)
04	Surface Finishing processes	06 (02)	06 (00)	00 (04)	12 (06)
05	Advanced welding & other Processes	02 (00)	04 (06)	06 (00)	12 (06)
06	Maintenance of Machine Tools	04 (00)	04 (04)	00 (00)	08 (04)
	Total	18 (08)	34 (00)	18 (10)	70(40)

R – Remember U – Understand A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	4	R	2	5	R	2	6	R	2	6	R	2	2	R	2	5/7
	4	R	2																
02	3	R	4	4	R	4	1	U	4	1	R	4	1	U	4				3/5
03	2	U	4	2	U	4	3	U	4	2	U	4	2	U	4				3/5
04	3	U	4	5	U	4	6	U	4	6	U	4	4	A	4				3/5
05	1	A	6	2	A	6	3	A	6										2/3
06	4	U	6	5	A	6	5	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets & Job	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Job	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Job drawing, selection of equipment's. writing procedure, precautions etc.	10
2	Performance	20
3.	Skill	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	3	-	-	1	-	-	-	-	3	3	3
2	-	3	-	-	-	-	-	-	-	3	3	3
3	-	3	-	-	-	-	-	-	-	3	3	3
4	-	3	3	3	-	-	-	3	3	3	3	3
5	-	3	3	3	-	-	-	3	3	3	3	3
6	-	3	3	3	-	-	1	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Workshop Technology (Vol. – II)	B. S. Raghuwanshi. Tata McGraw-Hill	81 -212-0269-8
2.	Workshop Technology (Vol. - II)	Hazara & Chaudhary. Media Promoters & Publishers.	0-210-98173-3
3.	Production Technology Volume- II	O. P. Khanna & Lal Dhanpat Rai Publications.	456714404X 13:1234567144042
4.	Nonconventional Machining	P.K.Mishra, Narosa Publishing House, 1997	10: 8173191387 13: 978-8173191381
5.	Industrial Maintenance	H.P.Garg, S.Chand (G/L) & Company Ltd; 3rd Revised edition, 1987	10: 8121901685 13: 978-8121901680
6.	Maintenance Engg. Handbook	L.R.Higgins, McGraw-Hill Education; 8 TH edition, 2014)	10: 0071826610 13: 978-0071826617
7.	Technology of Machine Tools	S.F.Krar, McGraw-Hill Education; 7 TH Edition , 2010	10: 0073510831 13: 978-0073510835
8.	Production Technology	HMT, McGraw-Hill Education;	9780070964433

9.	Advanced Machining Processes: Nontraditional and Hybrid Machining Processes	Hassan Abdel-Gawad El-Hofy, McGraw-Hill Education, 2005	10: 0071453342 13: 978-0071453349
10.	Rapid Prototyping: Laser-based and Other Technologies	Patri K. Venuvinod, Weiyin Ma, Springer; 2004	10: 1402075774 13: 978-1402075773

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=aC7c1NgA-7M>, assessed on 23rd March 2016
- <https://www.youtube.com/watch?v=is5wdVgPOkI>, assessed on 23rd March 2016
- <https://www.youtube.com/watch?v=UW7Pm3kXJT8>, assessed on 28th March 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Lathe Machine with all accessories
2. Cylindrical grinding machine with all accessories
3. Milling Machine with all accessories
4. Fitting, welding, tools and equipments as per requirement.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R. R. Chaudhari	HOD, Mechanical Engineering	Government Polytechnic Nagpur
2.	Dr. S. W. Rajurkar	Lecturer , Mechanical Engineering	Government Polytechnic Nagpur
3.	Mr. D. C. Satdeve.	Workshop Superintendent	Government Polytechnic Nagpur
4.	Er. A. M. Onkar	Chief Executive Officer	OnkarFurnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME407E ^s
COURSE TITLE	: MACHINE DESIGN
PREREQUISITE	: AM407E, ME402E
TEACHING SCHEME:	TH: 03; TU: 00; PR: 04
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 04 HRs
PR. TEE	: 02 HRs (External)
PT.	: 02 HRs

❖ RATIONALE:

Machine design is a professional course for mechanical engineer requiring prior knowledge of Strength of materials, Theory of machine, Engineering materials, Manufacturing processes, Mechanical engineering drawing. This course aims to provide fundamental knowledge for material selection, analysis of different types of machine elements subjected to various types of stresses, design of simple machine elements like shaft, keys, coupling, spring, levers, screw, joints and ergonomic concepts.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply philosophy, considerations and procedure of design of machine element and ergonomic.
2. Interpret the design procedure for machine parts shaft, key, coupling and fasteners.
3. Apply the design procedure for power screws and springs
4. Design machine element shaft, key and coupling.
5. Design fasteners and power screws.
6. Design various springs.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Introduction to Design	1. List steps in design procedure. 2. List general considerations in designing machine element. 3. State causes and remedies of stress concentration 4. Describe suitable theory of failure for given applications. 5. Illustrate ergonomic consideration to suit specific equipment	1.1 Machine Design philosophy and Procedures 1.2 General Considerations in Machine Design 1.3 Fundamentals - Principal Stresses, Creep and Creep Curve, Fatigue, S-N curve, Endurance limit, Factor of Safety and its selection, Stress Concentration - Causes & Remedies, Engineering materials: Properties and designation of materials, Use of design data book, Use of standards in design 1.4 Theories of Elastic Failures 1.5 Ergonomic consideration in design, Man machine relationship, Design of equipment for display and control, Aesthetic considerations regarding shape, size, color & surface finish	08
2. Design of Simple Machine Elements	1. State applications of various joints. 2. State application of various levers. 3. Select proper formulae 4. Apply various stress considerations 4. Identify possible failures. 5. Calculate various parameters as per requirement.	2.1 Design of Cotter Joint, Knuckle Joint and Turnbuckle 2.2 Design of Levers-Hand/Foot Lever & Bell Crank Lever, 2.3 Design of C-Clamp, , Overhang Crank, Arm of Pulley	08
3. Shaft, Key, Coupling, and Antifriction Bearings	1. Classify each mechanical elements 2. Select mechanical elements for specific condition 3. Apply various stress considerations. 4. Calculate various parameters as per requirement.	3.1 Shafts : Types, materials, standard sizes, Design of Shafts (Hollow and Solid) using strength and rigidity equation, Design of line shafts supported between bearings with one or two pulleys in between or one overhung pulley 3.2 Key: Classification, Design of sunk keys, Effect of keyways on strength of shaft 3.3 Coupling: Classification, Design of muff coupling, flange coupling, bush-pin type flexible coupling 3.4 Classification of Bearings – Sliding contact & rolling contact 3.5 Terminology of Ball bearings – life	10

		load relationship, basic static load rating and basic dynamic load rating. Selection of ball bearing using manufacturer's catalogue	
4. Design of Fasteners	1. Identify stresses in bolted joints. 2. Apply various stress considerations. 3. Calculate various parameters in bolted joints as per requirement. 4. Classify welded joints. 5. Calculate fillet welding parameters under different orientation	4.1 Stresses in Screwed fasteners, Bolts of Uniform Strength 4.2 Design of Bolted Joints subjected to eccentric loading 4.3 Design of parallel and transverse fillet welds, axially loaded symmetrical	08
5 Power Screw	1. Illustrate various thread profile for power screw. 2. Describe self-locking and overhauling concept. 3. Calculate efficiency of power screw, 4. Apply various stress consideration. 5. Identify various possible failures in Jacks. 6. Calculate various parameters of Jack.	5.1 Thread Profiles used for power Screws, relative merits and demerits of each. 5.2 Torque required to overcome thread friction, Self-locking and overhauling property, 5.3 Efficiency of power screws & Types of stresses induced, 5.4 Design of Screw Jack, Toggle Jack	08
6. Design of Spring.	1. Classify springs. 2. Define spring terminology and applications of springs. 3. Select various formulae. 4. Apply stress considerations for springs under various application. 5. Calculate parameters of spring.	6.1 Classification and Application of Springs. 6.2 Spring – terminology, materials and specifications 6.3 Stresses in springs, Wahl's correction factor, Deflection and Energy stored in springs 6.4 Design of Helical tension and compression springs subjected to uniform applied loads like I.C. engine valves, Weighing balance, Railway buffers and Governor springs	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Design Cotter joint, Knuckle joint or Turn buckle (Any two) 1. Apply various stress considerations. 2. Formulate various resisting areas. 3. Select appropriate formulae 4. Calculate various parameters 5. Draw assembly and detail drawings as per calculated dimensions.	Design of simple machine elements	8
2	Design of Lever and Bell crank lever (Any One) 1. Apply various stress considerations. 2. Formulate various resisting areas. 3. Use appropriate formulae 4. Calculate various parameters 5. Draw assembly and detail drawings as per calculated dimensions.		8
3	Design of shaft – (i) Line shaft supported in bearings with one or two pulleys & a gear (ii) Propeller shaft 1. Calculate torque and max. Bending moment. 2. Select appropriate failure theories Compensating factors to suit conditions. 3. Select appropriate formulae. 4. Calculate various parameters 5. Draw the concept drawing depicting conditions.	Shaft, Key, Coupling and antifriction Bearings	8
4	Design of coupling – (Any One) (i) Rigid flange coupling (ii) Flexible coupling. • Use Design data Book. • List the assumptions made 1. Calculate torque. 2. Select empirical relations from design data book. 3. Calculate various parameters. 4. Verify these dimensions under possible failures using formulated resisting areas. 5. Draw assembly and detail drawings as per calculated dimensions.		8
5	Design of bolted joint(eccentric loading) 1. Confirm appropriate loading condition. 2. Calculate load per bolts. 3. Apply various stress considerations. 4. Calculate bolt parameters.	Design of fasteners	8

6	Design of Screw jack or Power Screw 1. Apply various stress considerations. 2. Formulate various resisting areas. 3. Select appropriate formulae 4. Calculate various parameters. 5. Verify these dimensions under possible failures using formulated resisting areas. 6. Draw assembly and detail drawings as per calculated dimensions.	Power Screw	8
7	Design of Helical spring • Use Design data Book. • List the assumptions made 1. Calculate torque. 2. Select appropriate formulae. 3. Calculate wire diameter. 4. Select standard wire diameter. 5. Calculate various parameters 6. Draw the concept drawing	Design of springs	6
8	Prepare two assembly drawings on auto-cad from drawings covered above practical. 1. Select appropriate CAD commands. 2. Draw the assembly drawing.	All Topics	8
Skill Assessment			4
Total Hrs			64

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to design	00(02)	12(04)	00(00)	12(06)
02	Design of simple machine elements	04(00)	00(00)	08(06)	12(06)
03	Shaft, Key, Coupling, and antifriction Bearings	02(00)	00(06)	12(00)	14(06)
04	Design of fasteners	02(00)	06(00)	04(08)	12(08)
05	Power Screws	00(02)	04(00)	08(04)	12(06)
06	Design of springs	02(00)	00(04)	06(00)	08(04)
	Total	10 (04)	22(14)	38 (18)	70 (36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	3	2	R	2	3	R	2	4	R	2	5	R	2	5/7
	6	R	2																
02	1	U	4	1	U	4	1	U	4	1	U	4	6	U	4				3/5
03	2	A	6	2	A	6	3	U	6										2/3
04	3	A	6	4	U	6	6	U	6										2/3
05	4	A	4	5	U	4	5	A	4										2/3
06	2	A	8	4	A	8	5	A	8										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Data representation (Given / Standard), Assumptions (If any)	10
2	Calculation and results	20
3	Drawing / Sketching	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	3	3	3	3	3	–
2	–	3	–	–	–	–	–	3	3	3	3	–
3	–	3	–	–	–	–	–	3	3	3	3	–
4	–	3	3	3	–	–	3	3	3	3	3	–
5	–	3	3	3	–	–	3	3	3	3	3	–
6	–	3	3	3	–	–	3	3	3	3	3	–

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Introduction to Machine Design	V. B. Bhandari, Tata Mc-Graw Hill 2001	0070434492
2.	Machine Design	R. K. Jain, Khanna Publication	8174090991
3.	Machine Design	Pandya & Shah, Dhanpat Rai & Son Third Edition	81-74009-205-6
4	Mechanical Engineering Design	Joseph Edward Shigley, Mc-Graw Hill 2004	0072520361
5	Design Data Book	PSG Coimbatore.	1-55798-273-2
6	Hand Book of Properties of Engineering Materials & Design Data for Machine Elements	Abdulla Shariff, Dhanpat Rai & Sons.2001	9780210223680
7	Theory and Problems of Machine Design	Hall, Holowenko, Laughlin, Mc- Graw Hill.1980	007084352X

❖ **E-REFERENCES:**

- www.youtube.com/watch?v=CLeLFUvvO2g , assessed on 7th September, 2016
- <http://www.uni.edu/~rao/Md-17%20Shaft%20Design.pdf> , assessed on 7th September, 2016
- www.youtube.com/watch?v=Wyv7_WFaSzc, assessed on 7th September, 2016
- www.youtube.com/watch?v=CLeLFUvvO2g, assessed on 7th September, 2016, assessed on 7th September, 2016
- <https://engineeringexcellence.files.wordpress.com/2011/10/screw-jack-design.pdf>, assessed on 7th September, 2016
- <http://blog.mechguru.com/machine-design/how-to-design-a-helical-compression-spring/>, assessed on 7th September, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Models of various power transmission drives

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. M. S. Deshpande	Lecturer, Mechanical Engineering	Government Polytechnic, Nagpur
2.	Dr. R. R. Choudhari	HOD, Mechanical Engineering	Government Polytechnic, Nagpur
3	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
4	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
5	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME408E ^s
COURSE TITLE	: REFRIGARATION AND AIRCONDITIONING
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 03; TU: 00; PR: 02 (CLOCK HR)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT=2 CLOCK HR.)
TH. TEE	: 03 HR
PR. TEE	: 02 HR (External)
PT.	: 01 HR

❖ RATIONALE:

With the increase in standard of living of people & society in general, the use of refrigeration & air-conditioning systems has become very common. Hence the mechanical technicians are required to know about the systems. The knowledge of various refrigeration systems, their thermodynamic analysis & different types of refrigerants is one of the basic requirements. It is also expected that they are conversant with various refrigerating equipments & controls, basics of cryogenics and psychrometry.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze the performance of different refrigeration systems
2. Appraise of modern trends in the field of refrigeration and air conditioning.
3. Select the proper refrigeration and air Conditioning system.
4. Diagnose faults and suggest remedial measures in refrigeration an air conditioning system.
5. Operate test rigs of air-conditioning unit.
6. Calculate COP of various refrigeration systems

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Basics Of Refrigeration	1. Define refrigeration, COP and Refrigeration effect 2. Describe the concept of heat engine, heat pump and refrigerator 3. Draw PV and TS diagram of reverse Carnot cycle 4. Describe the Bell Coleman air refrigerator	1.1 Introduction:- Definition of refrigeration, Necessity of refrigeration, Concept of heat engine, heat pump and refrigerator. Unit of refrigeration, C.O.P. and refrigerating effect. 1.2 Reversed Carnot Cycle and its representation on PV and TS diagram. (numerical to find out COP) 1.3 Air Refrigeration Cycles 1.4 Bell Coleman air refrigerator, it's representation on PV and TS	6
2. Refrigeration System And Refrigerants	1. List the different components of VCRC 2. State the effect of wet compression, dry compression on COP. 3. Describe the effect of superheating, under cooling, suction pressure and discharge pressure on performance of VCRC 4. Calculate the COP of VCRC 5. State the advantages of VCRC 6. Describe the working principle of Vapour Absorption System 7. State the desirable properties of Refrigerant and absorbent used in Vapour Absorption System 8. State the desirable properties of refrigerants 9. State how refrigerant is selected for specific application 10. Describe the concept of Green House Effect, Ozone depletion, Global warming	2.1 Vapour Compression Refrigeration Cycle (V.C.R.C): principle, components, Representation on P-H and T-S diagram, effects of wet compression, dry compression, calculation of COP, Effect of superheating, under cooling, suction pressure and discharge pressure, Actual V. C. R. system, (numerical to find out COP of VCRC), Introduction to multistage V. C. R. Cycle, its necessity, advantages 2.2 Vapour Absorption Refrigeration system : Principle, components and working of aqua- ammonia system (simple & practical) Li-Br Absorption System Electrolux Refrigeration System, Desirable properties of Refrigerant and absorbent used in Vapour Absorption System 2.3 Refrigerants : Classification of refrigerants, Desirable properties of refrigerants, Nomenclature of refrigerants, Selection of refrigerant for specific applications, Concept of Green House Effect, Ozone depletion, Global warming, Eco-friendly refrigerants like , R-134a alternate refrigerants etc, Retrofitting for switchover from conventional refrigerant to eco friendly refrigerant(theoretical concept ,& problems associated with retrofitting.)	10
3. Components Of Vapour Compression	1. Describe the construction and working of compressor, condenser, expansion valve,	3.1 Compressors - Classification, Construction and working of open type, hermetic, centrifugal, root	10

Refrigeration System.	evaporators and chillers. 2. State the different components of hermitically sealed compressor. 3. State the function of expansion devices 4. Select different controller for particular VCRS application. 5. Classify evaporator and chiller.	blower, vane type, axial, screw compressor and their applications. 3.2 Condensers - Classification, description of air cooled and water cooled condensers, comparison and applications. Evaporative condensers 3.3 Expansion devices - Types - Capillary tube, automatic expansion valve, thermostatic expansion valve and their applications 3.4 Controls - High pressure & low pressure cut-outs, high voltage & low voltage control, thermostat & overload protector, relay. Accumulator, strainer, drier, oil separator, their functions & locations 3.5 Evaporators and Chillers - Classification of evaporators working principle of Bare tube, Plate surface, finned, shell and tube, flooded and dry expansion evaporator, Capacity of evaporator and their applications. Classification of chillers, Construction and working of dry expansion Chillers and flooded chillers and their applications.	
4. Psychrometry	1 State the necessity of air conditioner 2 State Dalton's law of partial pressure 3 Describe the different Psychrometric processes and show it on Psychrometric chart 4 Calculate SHF, RSHF, ERSHF, GSHF 5 Describe the working of equipments used for Air-conditioning like humidifier, dehumidifier, filter, heating and cooling coils 6 Draw comfort chart	4.1 Definition and necessity of air conditioning, 4.2 Properties of Air, 4.3 Dalton's law of partial pressure, 4.4 Psychrometric chart, 4.5 Psychrometric processes, Bypass Factor, ADP, concept of SHF, RSHF, Adiabatic mixing of Air streams, (numerical using Psychrometric chart to find out SHF, RSHF) 4.6 Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils, 4.7 Factors affecting human comfort, Effective temp. and comfort chart	10
5. Air Conditioning System	1. Classify the A.C. systems 2. Distinguish between Industrial and commercial A.C. systems 3. Select A.C. system for particular working condition 4. State the application of A.C. systems	5.1 Classification of A.C. systems 5.2 Industrial and commercial A.C. systems 5.3 Summer, winter and year round A.C. systems 5.4 Central and unitary A.C. systems 5.5 Application of A.C. systems	6

6. Air Distribution Systems	1. State the various duct material and losses in ducts 2. Describe the working of fans and blowers 3. State the types and properties of insulating materials. 4. How the insulation is applied.	6.1 Duct systems -Closed perimeter system, extended plenum system, radial duct system, duct materials, requirement of duct materials, losses in ducts 6.2 Fans and Blowers -Types, working of fans and blowers 6.3 Air distribution outlets: - Supply outlets, return outlets, grills, diffusers 6.4 Insulation - Purpose, properties of insulating material, types of insulating materials, methods of applying insulation.	6
Total Hrs			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify the components of water cooler test rig.	Refrigeration System And Refrigerants	2
2	Calculate the COP of water cooler test rig		2
3	Identify the components of ice plant test rig.		2
4	Calculate the COP of ice plant test rig		2
5	Identify the components of domestic refrigerator.		2
6	Calculate the COP of domestic refrigerator/VCRS.		2
7	Identify various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC	Components Of Vapour Compression Refrigeration System.	2
8	Identify components of 'hermetically sealed compressor.		2
9	Prepare a report of Visit to cold storage industry/ central A.C. plant in view of ducting system, insulation system and Air distribution system (e.g. frozen food industry/ice-cream industry/mushroom plants/textile industries)..		6
10	Identify the components of A.C. test rig.	Air Conditioning System	2
11	Calculate the COP of A.C. test rig		2
12	Troubleshoot domestic refrigerator/ window air- Conditioner	Air Distribution Systems	4
Skill Assessment			2
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Basics of Refrigeration	04(00)	04(04)	00(00)	08(04)
02	Refrigeration System And Refrigerants	02(02)	10(00)	00(06)	12(08)
03	Components of Vapour Compression Refrigeration System.	04(04)	08(00)	06(00)	18(04)
04	Psychrometry	04(02)	04(08)	06(00)	14(10)
05	Air Conditioning System	04(00)	04(00)	00(06)	08(06)
06	Air Distribution Systems	00(04)	04(04)	06(00)	08(08)
	Total	18(12)	34(16)	18 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	3	R	2	3	R	2	4	R	2	5/7
	2	R	2																
02	1	U	4	5	R	4	4	R	4	4	U	4	3	R	4				3/5
03	2	U	4	3	U	4	3	U	4	6	R	4	4	U	4				3/5
04	6	U	4	5	U	4	4	U	4	1	U	4	6	U	4				3/5
05	2	U	6	6	A	6	2	A	6										2/3
06	4	A	6	3	A	6	5	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing diagrams of experiment set up, equipments, writing procedure, etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	–	–
2	–	3	–	–	3	3	–	–	–	3	–	3
3	–	3	–	–	3	3	3	–	–	3	3	3
4	–	3	3	3	–	3	3	3	3	3	3	3
5	–	3	3	3	–	–	3	3	3	3	3	3
6	–	3	3	3	–	–	–	3	3	3	–	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	A Textbook of Refrigeration and Air Conditioning	R. S. Khurmi, J.K. Gupta, S Chand & Co Ltd, 1 st Edition, 2006	13: 978-81-219-2781-9 81-219-2781-1
2.	Refrigeration and Air Conditioning	C. P. Arora, Tata Mc-Graw Hill, 3 rd Edition, 2014	10: 0071267565 13: 9780071267564
3.	Refrigeration and Air Conditioning	Manohar Prasad, New Age Publications. 2 nd Edition, 2011	13: 9788122414295
4.	Basic Refrigeration and Air Conditioning	P. N. Ananthanarayanan, Tata McGraw Hill, 1983	10: 0-07-451515-2 13: 978-0-07-451515-0

❖ **E-REFERENCES:**

- 1) <http://slideshare.in/wapakunungkuy/refrigeration-andairconditioningnotes>
- 2) [http://nptel.ac.in/courses/Webcourse-content/IIT_Kharagpur/Ref and Air Cond/New_index1.html](http://nptel.ac.in/courses/Webcourse-content/IIT_Kharagpur/Ref_and_Air_Cond/New_index1.html)
- 3) [http://freevidelectures.com/Course/2372/ Refrigeration-and-Air-Conditioning](http://freevidelectures.com/Course/2372/Refrigeration-and-Air-Conditioning)

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Air conditioning trainer kit
2. Water cooler trainer kit
3. Ice plant trainer kit
4. Window Air conditioner
5. Split air conditioner
6. Domestic Refrigerator
7. Car air conditioning trainer kit

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Prof. O. V. Sarode	Lecture, Mechanical Engineering	Government Polytechnic, Nagpur.
2	Prof. S. A. Dhankute	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Prof. D. J. Ghode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME409E ^s
COURSE TITLE	: CNC MACHINES
PREREQUISITE	: WS401E
TEACHING SCHEME:	TH: 02; TU: 00 ; PR: 02
TOTAL CREDITS	: 03 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (External)
PT.	: 01 HR

❖ RATIONALE:

This is Technology course which has relevance with the courses taught earlier namely Manufacturing Processes and advanced manufacturing processes. After getting conversant with the basic manufacturing processes and production processes, it is necessary for a technician to know about the advancements in the area of manufacturing and production processes. The subject will impart knowledge & skills necessary for working in modern manufacturing environment.

This subject will help the student to get familiarized with working principles and operations performed on CNC machining centers, generation of part program and study tooling of CNC machine.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Select CNC machine for given type of work.
2. Apply G code and M code for specific machining process.
3. Select sequential tool list for given machining process.
4. Develop CNC program for sequence of operation.
5. Operate CNC machine for given job.
6. Measure dimensions of finished product for confirmation to drawing.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Introduction to CNC machines.	1. Define NC, CNC, and DNC. 2. Classify CNC Machines. 3. Operate CNC control panel. 4. Describe principle axes of CNC Machine	1.1 NC (Numeric control), CNC (Computer numeric control), DNC (Direct Numeric control) definition. 1.2 Classification of CNC machines. 1.3 Difference between CNC and NC, relative advantages and disadvantages. 1.4 CNC organization – CNC machine body and control panel, CNC machine tool working principle. 1.5 Cartesian Co-ordinate system and right hand rule for identification of axes.	06
2 Construction and working principle of CNC machine.	1. Distinguish CNC machine on the basis of constructional features. 2. Differentiate CNC lathe, Vertical and Horizontal milling machine. 3. List components of CNC machine 4. Describe features Multi-axis CNC machine	2.1 Construction and working of CNC turning centre, VMC and HMC 2.2 Construction and working of CNC turn mill centre 2.3 Construction and working of Multi- axis CNC machines	04
3 Special features of CNC Machine components.	1. Define various terms related to construction of CNC. 2. Describe construction and working of the different components, subassemblies, assemblies and peripherals of CNC machines. 3. Describe working of lubrication system used in CNC Machines. 4. Draw circuit diagram of pneumatic and Hydraulic system used in working of CNC	3.1 Bed and machine frame construction. 3.2 Spindle constructional details 3.3 Constructional details and working of ball screw and L.M. guide ways. 3.4 Various Spindle drives used in CNC machines. 3.5 Working of Machine control unit. 3.6 Types of lubrication systems used for CNC machines. 3.7 Working of hydraulic and pneumatic systems used for chuck, tool and pallet changing in CNC machines.	06

	Machine. 5. Identify common faults in CNC machines and suggest remedies.		
4 Manual Part Programming for CNC Lathe centre.	1. State different G and M codes. 2. Describe function of Codes used in manual part programming. 3. Develop CNC part programming according to the drawing of the component. 4. Select and apply suitable lathe for machining of component.	4.1 NC words, G codes (Preparatory function), M codes (Miscellaneous functions) 4.2 Programming format, word statement, block format. 4.3 Lathe co-ordinate system. Tool path co-ordinates. Interpolation functions 4.3 Facing and turning program. 4.4 Tool nose radius compensation. 4.5 Chamfer and taper programs. 4.6 List and Application of CNC Lathe cycles	06
5 Manual Part Programming for CNC VMC/HMC (Vertical/ horizontal Milling Centre)	1. Define terms related to tool offset and cycles. 2. Develop linear interpolation program for given drawing. 3. Develop circular interpolation program for given drawing. 4. Select and apply suitable canned cycle for given job.	5.1 Linear interpolation Program. 5.2 Circular interpolation Program. 5.3 Cutter radius compensation. 5.4 Tool offset. 5.5 Introduction to Canned cycles.	06
6 Tooling for CNC machines.	1. State types of CNC cutting tools for CNC and VMC/HMC. 2. Describe construction and working of tool holding assembly. 3. Describe tool presetting procedure. 4. Describe working principle of Automatic tool changer. 5. State safety precautions while working on CNC Machines.	6.1 Types of CNC Cutting tools 6.2 Types of index able inserts with its geometry 6.3 Construction of tool holding assembly 6.4 Tool presetting procedure 6.5 Working of Automatic Tool Changing (ATC) device and types of tool magazine 6.6 Safety Procedures, alarms, fool-proof procedures.	04
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Unit	Hrs.
1	Prepare report on control systems employed in the CNC machine centre observed during visit to industry.	Introduction to CNC machines.	4
2	Prepare report on constructional feature of CNC machine centre observed during visit to industry.	Construction and working principle of CNC machine.	4
3	Prepare report on special features of CNC machine centre observed during visit to industry.	Special features of CNC Machine components.	4
4	Prepare One job on CNC lathe having plain turning, taper turning, step turning, threading, boring and grooving (Batch of 4-5 students).	Manual Part Programming for CNC Lathe centre.	8
5	Prepare One job on CNC milling having following operations – face milling, slotting, contour machining (Batch of 4-5 students)	Manual Part Programming for CNC VMC/ HMC (Vertical/ horizontal Milling Centre)	8
6	Prepare report on selection of cutting tools used for CNC lathe and milling during practical no. 4 & 5.	Tooling for CNC machines.	4
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction to CNC machines	04(02)	08(04)	00(00)	12(06)
2	Construction and working principle of CNC machine.	04(00)	08(06)	00(00)	12(06)
3	Special features of CNC Machine components	04(00)	08(04)	00(06)	12(10)
4	CNC Lathe center manual part programming	02(00)	04(04)	06(00)	12(06)
5	CNC Vertical Mill center manual part programming	06(04)	00(02)	06(00)	12(06)
6	Tooling for CNC machines	04(04)	06(04)	00(00)	10(08)
	Total	24(10)	34(24)	12 (06)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	2	R	2	4	R	2	1	R	2	5/7
	5	U	2																
02	3	R	4	1	U	4	1	U	4	1	U	4	3	U	4				3/5
03	2	U	4	2	U	4	3	U	4	5	R	4	4	U	4				3/5
04	6	R	4	3	U	4	4	U	4	6	R	4	6	U	4				3/5
05	3	U	6	6	U	6	2	U	6										2/3
06	4	A	6	5	A	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Description of observed features of CNC Machine in the report.	10
2	Development of manual part program.	15
3	Execution of developed program on CNC machine	15
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	–	3
2	–	3	–	–	–	–	–	–	–	3	–	3
3	–	3	–	–	–	–	–	–	–	3	–	3
4	–	3	3	3	–	–	3	3	3	3	3	3
5	–	3	3	3	–	–	3	3	3	3	3	3
6	–	3	3	3	–	–	3	3	3	3	3	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	CNC Machines	Adithan M., Pabla B. S., New Age Publications.	9780071623018
2.	CNC Machine Hand Book	Alan Overby, Mc Grow Hill	9788122834262
3.	CAD/ CAM/ CAE	Chougule N. K., Scitech Publication Pvt Ltd	9788183711753
4.	CNC Programming Made Easy	Binit Kumar Jha, Vikas Publication House Pvt. Ltd.	9788125911807

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/112103174/37>, assessed on 29th October, 2016
- <http://www.egr.msu.edu/~pkwon/me478/operations.pdf>, assessed on 29th October, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- CNC Turning Machine Center.
- CNC Vertical/Horizontal Machine Center.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. A. R. Sheikh	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. D. C. Satdeve	Workshop Supdt.	Government Polytechnic, Nagpur.
3.	Mr. M. S. Deshpande	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

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GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME410E
COURSE TITLE	: COMPUTER AIDED DRAFTING
PREREQUISITE	: ME301E
TEACHING SCHEME:	TH: 01; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 03 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

Now a day a manual drafting is obsolete in industry. Computers being the inevitable part in an engineer's life due to its inbuilt characteristics which helps him to do various task with acceleration. Using computers and Computer Aided Drafting (CAD) software it is easy to create and modify a drawing which ultimately saves time. It also may be useful to generate assembly and manufacturing drawings.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Create, save CAD drawing files and modify particular drawing
2. Use drafting set-up
3. Modify 2D and isometric drawing
4. Integrate layers and blocks in drawing
5. Develop customized drawing template
6. Print drawing.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 CAD Basics	1. Identify components of CAD screen. 2. Describe the procedure to Create new drawing 3. Describe toolbar and commands 4. Describe the procedure to Edit drawing	1.1 Getting acquainted with CAD, Starting CAD, CAD screen layout, drawing area, menu and toolbars, status bar 1.2 Creating a new drawing, working with toolbar and commands, changing drawing limits, creating rectangle etc. saving drawing for first time 1.3 Opening and existing drawing file, CAD Cartesian workspace, working with drawing editor, closing a drawing and exiting from CAD	02
2 Drawing in Two Dimensions	1. State drafting set-up 2. Describe the procedure to Create 2D drawing with Draw commands 3. Identify and select draw commands for particular drawing 4. Describe the procedure to Use view options for drawing	2.1 Drafting set-up: units, angle, area, coordinate system, limits, grid, object snap, line type and line weight 2.2 Draw commands: Drawing line, polyline, spline, rectangles, polygons creating construction lines, creating rays 2.3 Drawing circles, arcs, ellipses, Donuts, placing points, changing points style, text 2.4 Creating two dimensional drawings using draw commands, Viewing your drawing- zoom, pan, window, aerial view, viewport, undoing and redoing action, save and exit	02
3 Modifying the Drawing	1. Modify the 2D drawing with edit commands 2. Identify and select proper edit command for particular editing 3. Describe the procedure to Use edit commands 4. Interpret draw and modify commands 5. Describe the procedure to Change properties of drawing entities	Modify commands: 3.1 Editing object, understanding object selection basic, erasing object, moving object, coping object, rotating object, scaling object, using change command 3.2 Copying and moving object using MIRROR command, ARRAY command, Offsetting object, resizing command, extending object, stretching object 3.3 Modify the created object using-copy, mirror, hatch, divide, explode, join, pedit, offset, array,	02

		move, rotate, scale, stretch, trim, chamfer etc. command	
4 Dimensioning, Layout and Printing	1. Identify dimensioning techniques 2. Describe the procedure to Use annotate menu for dimensioning drawing 3. Describe the procedure to Create hatching 4. Describe the procedure to Set up layout for printing 5. Describe the procedure to Carry out printing of drawing	4.1 Dimensioning/annotating your drawing-Working with annotation, adding text in drawing, modifying and formatting multiline text 4.2 Hatching 4.3 Adding dimensions- dimensioning concept, adding linear, radial, angular dimensions, adding notes to your dimensions 4.4 Setting up layout- printing concept, creating view ports, setting up layouts, guideline for layouts 4.5 Printing your drawing: Preparing drawing for plotting or printing, creating layout in paper space, working with plot style, Plotting a drawing- choosing a plotter/printer, preview/creating the plot	03
5 Isometric Drawing	1. Create isometric environment. 2. Identify isometric setup 3. Classify circle and isocircle 4. Select proper plane for isometric drawing 5. Describe the procedure to Draw isometric drawing	5.1 Isometric mode- grid, snap, standard/isometric 5.2 Isoplane-orientation of crosshairs, isotop, isoright and isoleft 5.3 Drawing isometric circles- set isoplane, use ellipse- isocircle 5.4 Isometric text- oblique angle, rotation angle, style, dynamic text 5.5 Creating isometric drawing	04
6 Drawing Organization and information	1. Describe the procedure to Create customized template 2. Interpret components in different layers. 3. Describe the procedure to Collect information from drawing 4. Describe the procedure to Insert proper block 5. Describe layers and block	6.1 Creating new drawing with template 6.2 Working in layers 6.3 Getting information from your drawing- measuring objects, working with properties 6.4 Inserting blocks- inserting blocks from tool pallets, inserting block using insert, inserting block with design center	03
		Total Hrs.	16

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify and locate components of CAD classic screen by creating new drawing.	CAD Basics	4
2	Draw a line diagram using absolute coordinate method. Use LIMITS, UNITS, LINE, ARC Commands	Drawing in Two Dimensions	6
3	Draw a line diagram using relative coordinate and relative polar coordinate method.		6
4	Draw a 2D figure using Draw and Modify commands. Use LINE, CIRCLE, OFFSET, TRIM, FILLET commands.	Drawing in Two Dimensions and Modifying the Drawing	6
5	Draw a 2D figure using Draw and Modify commands. Use LINE, ARC, POLYGON, ELLIPSE, COPY, MIRROR, TRIM, ROTATE, CHAMFER commands.		6
6	Draw 2D drawing of mechanical component using required commands. (any one component like gear, pulley, bearing etc. may be selected)		6
7	Dimension the object. Open the previously saved file and dimension the lines, arc, circle, polygon etc.	Dimensioning, Layout and Printing	8
8	Plot the drawing from model space and print it.		6
9	Draw isometric drawing of mechanical component. Use LIMITS, UNITS, ZOOM, GRID, SNAP, LINE, COPY, ISOPLANE, ELLIPSE, TRIM, ERASE, PROPERTIES, SAVE Commands	Isometric Drawing	8
10	Create the customized template, draw title block using LAYER, RECTANGLE, EXPLODE, TEXT, AND COPY Commands.	Drawing Organization and information	8
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER : Nil**❖ **QUESTION PAPER PROFILE FOR THEORY PAPER : Nil**

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal & Printouts	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Using drafting set up /aids	10
2	Drawing diagrams of 2D or isometric given figure	20
3	Dimensioning figure	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	3	–	–	–	–	–	3	3	–
2	–	3	–	3	–	–	–	–	–	3	3	–
3	–	3	–	3	–	–	–	–	–	3	3	–
4	–	3	3	3	–	–	–	3	3	3	3	–
5	–	3	3	3	–	–	–	3	3	3	3	–
6	–	3	3	3	–	–	–	3	3	3	3	–

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE and TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	AutoCAD 2002 Bible	Ellen Finkelstein, IDG Books India(P) Ltd., First Edition, 2001	81-265-0233-9
2.	AutoCAD 2016 and AutoCAD LT 2016	Donnie Gladfelter, John Wiley and Sons. Inc. Indiana, First Edition, 2016	978-1-119-05955-4
3.	AUTOCAD IN 3D	Frank J. Johnson, McGraw Hill Inc., New Delhi, First Edition, 1992	0-07-112653-8
4.	Mastering AutoCAD 13	George Omura, BPB Publication, New Delhi, First Edition, 1997	81-7029-785-0
5.	Engineering Drawing	N. D. Bhatt, Charotaar Publishing House Pvt. Ltd., Anand, Gujrat, 51th Edition, 2012	978-93-80358-55-0
6.	A text book of Engineering Drawing	P. J. Shah, S. Chand and Co.Ltd., New Delhi, First Edition, 2008	81-219-2964-4
7.	Engineering Drawing with introduction to AutoCAD	Dhananjay A Jolhe, Tata McGraw-Hill Co. Ltd., New Delhi, 2 nd Edition, 2008	978-0-07-064837-1
8.	AutoCAD 2016 exercise workbook for windows	Cheryl R. Shrock and Steve Heather, Industrial Press Inc. South Norwalk, USA, First Edition, 2016	978-0-8311-3518-8

❖ **E-REFERENCES:**

- http://www.mycadsite.com/tutorials/level_3/isometric-drawing-in-autocad-3-2.htm , assessed on 27th June, 2016
- <http://www.cadlearning.com/courses/autocad-mechanical-training-tutorials/> , assessed on 27th June, 2016
- <http://www.staff.city.ac.uk/~ra600/ME1105/Tutorials/CAD-1/Tutorial%20CAD-1a.pdf> , assessed on 28th June, 2016
- https://www.youtube.com/watch?v=yruPUj_61bw , assessed on 29th June, 2016
- <https://www.youtube.com/watch?v=Nv8skZZcUlw> , assessed on 29th June, 2016
- <https://www.youtube.com/watch?v=Lz6piHlBn7g> , assessed on 30th June, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. CPU with Intel (R) Core (TM) i3 processor or higher latest version
2. A color monitor with highest 32 bit/ 64 bit color display and with screen resolution 1024 by 768 pixels.
3. A scroll mouse.
4. Laser printer
5. Windows 7 operating system or latest operating system
6. Any one open source CAD software at AICTE website

❖ **LIST OF EXPERTS and TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R. R. Chaudhari	Head of Department, Mechanical Engineering	Government Polytechnic, Nagpur
2.	Shri. G. H. Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
3.	Dr. V. M. Athawale	Head of Department, Mechanical Engineering	Government Polytechnic, Yawatmal
4.	Mr. K. S. Thekedar	Lecturer in Mechanical Engineering	Government Polytechnic, Bramhapuri
5.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
7.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME411E
COURSE TITLE	: CAD/CAM
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 02; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT = 2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

CAD/CAM (Computer Aided Design / Computer Aided Manufacturing) 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. CAM include the use of computer to plan manage & control the operation in manufacturing plant through either direct or indirect computer interface with plant production resources.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use CAD/CAM hardware and software
2. Develop geometric modeling features
3. Construct geometric modeling : wireframe modeling, surface modeling, solid modeling
4. Create assembly of components and generate exploded view
5. Print mechanical modeling and prepare orthographic and sectional views from solid model
6. Execute CNC program.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Fundamentals of CAD/CAM	1. Describe CAD/CAM 2. State product life cycle 3. Describe design process 4. Describe the process to Create manufacturing data 5. Identify CAD/CAM hardware 6. Select CAD/CAM software	1.1 Roles of computers in industrial Manufacturing 1.2 What is CAD? What is CAM? 1.3 Product life cycle 1.4 The design process 1.5 Creating the manufacturing data base 1.6 Applications of CAD/CAM 1.7 CAD/CAM hardware 1.8 CAD/CAM software	03
2 Basics of Geometric Modeling	1. Describe the process to geometric modeling 2. Apply geometric modeling features 3. Describe the process to use editing features of geometric modeling 4. Describe the process to use plotting features	2.1 Introduction, Requirement of geometric modeling, geometric models, 3D modeling workspace and navigation 2.2 Geometric construction methods: wireframe modeling, surface modeling, solid modeling, extrusion, sweeping, feature modeling 2.3 Modeling facilities desired: drafting features, modeling features, editing features, annotations, dimensioning and hatching features 2.4 Plotting features	06
3 Solid Modeling - Basic	1. Describe the process to create Plane axis, points 2. Describe the process to construct Solid using Extrude, Revolve, Sweep 3. Apply Round, chamfer, Rib to solid 4. Describe the process to carry out solid modeling with datum Planes.	3.1 Understanding/creating of Planes, axis, points. 3.2 Creating Solid using Extrude, Revolve, Sweep, 3.3 Modifying & Regenerating by Edit Definition, Applying Round, chamfer, Rib, 3.4 Creating & Working with datum Planes, Axis, curves, datum Points, Auto round.	06
4 Solid Modeling - Advance	1. Describe the process to create solid model using Holes, Spring & Threads 2. Describe the process to use Swept blend, Helical sweep, Warp & draft 3. Describe the process to create solid 4. Describe the process to create customize screen	4.1 Creating Holes, Spring & Threads using Helical sweep 4.2 Swept blend, Helical sweep, Warp, Applying Draft 4.3 Copying features, Patterning 4.4 Blending, View manager for Cross sections, 4.5 customize screen, Environment	06
5 Assembly Modeling	1. Describe the process to draw or call components for assembly 2. Describe the process to	5.1 Calling components, Constraining components 5.2 Working with Layers & Visibility, Patterning,	06

	construct assembly with layers & pattern 3. Apply Assembly features 4. Describe the process to create assembly modeling 5. Generate exploded views 6. Generate orthographic views	5.3 Creating Assembly features 5.4 View manager, Exploded Views 5.5 Creating Assembly Models: Top-Down approach, Bottom-Up approach 5.6 Create projection views –Front, Top, side view and sectional views	
6 Computer Aided Manufacturing (CAM)	1. Describe manufacturing and automation 2. Describe 3D printing 3. List the types of 3D printing 4. Select proper material for 3D printing 5. Generate G codes & execute by using 3D printer	6.1 Introduction to manufacturing and automation 6.2 Introduction to 3D printing technology 6.3 Types of 3D printing 6.4 Material used for 3D printing 6.5 Generation of G codes of 3D drawing and its execution by using 3D printer	05
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Draw 2 dimensional figure using Solid Modeling sketcher commands.	Fundamentals of CAD/CAM	04
2	Create 2D plan of any mechanical object and convert it into 3 D modeling.	Basics of Geometric Modeling	06
3	Create 3 D surface modeling and visualization of any one components	Solid Modeling - Basic	08
4	Create 3 D solid modeling of any one components	Solid Modeling - Advance	10
5	Create assembly of mechanical component by Top-Down/ Bottom-Up approach (Minimum five parts)	Assembly Modeling	08
6	Generate exploded view of an assembly	Assembly Modeling	12
7	Prepare orthographic and sectional views from solid model	Assembly Modeling	08
8	Generate G codes program of 3D drawing and execute by using 3D printer	Computer Aided Manufacturing (CAM)	08
Total Hrs.			64

❖ SPECIFICATION TABLE FOR THEORY PAPER : Nil

❖ QUESTION PAPER PROFILE FOR THEORY PAPER : Nil

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal & Printouts	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Using drafting set up /aids	10
2	Creating any one geometric modeling (wireframe/ surface/solid modeling) OR create assembly	20
3	Dimensioning	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	–	–
2	–	3	3	3	–	–	3	–	–	3	–	–
3	–	3	3	3	–	–	3	–	–	3	–	–
4	–	3	3	3	–	–	3	3	3	3	3	3
5	–	3	3	3	–	–	3	3	3	3	3	3
6	–	3	3	3	–	–	3	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	CAD/CAM (Computer Aided Design/ Computer Aided Manufacturing	Suresh Dalela & P.K.Jain, S. Chand & Company Ltd., New Delhi, First Edition, 2000	81-219-1784-0
2.	CAD/CAM (Computer Aided Design/ Computer Aided Manufacturing	Mikell P. Groover & Emory W. Zimmers, Prentice Hall of India Pvt. Ltd., New Delhi, 05 th Edition, 1997	978-81-7758-416-5
3.	CAD/CAM Concept and Applications	Chennakesava R. Alavala, PHI Learning Pvt. Ltd, Delhi, Sixth Edition, 2015	978-81-203-3340-6
4.	CAD/CAM Principles and Applications	P.N.Rao, Tata McGrawHill Education Pvt. Ltd.,New Delhi, Third Edition, 2010	978-0-07-068193-4
5.	CAD/CAM/CIM	P. Radhakrishnan, S. Subramhanyam, V. Raju, New Age international Publisher, New Delhi, Second Edition, 2000	81-224-1248-3
6.	Pro Engineer Wildfire 4 for Designers	Sham Tickoo, Dreamtech Press, New Delhi, 2010	978-81-7722-904-2

❖ **E-REFERENCES:**

- <https://www.youtube.com/user/caddsoftsolutions> , assessed on 29th June, 2016
- <http://bobcad.com/training/lessons/>, assessed on 29th June, 2016
- <https://www.youtube.com/watch?v=83rhQ6oehIc> , assessed on 30th June, 2016
- <https://www.youtube.com/watch?v=xBE9eLQ5Cxc> , assessed on 30th June, 2016
- <https://www.youtube.com/watch?v=hq47wq9qBbs> , assessed on 30th June, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. CPU with Intel (R) Core (TM) i3 processor or higher latest version
2. A color monitor with highest 32 bit/ 64 bit color display and with screen resolution 1024 by 768 pixels.
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. CNC Trainer Machine

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R. R. Chaudhari	Head of Department, Mechanical Engineering	Government Polytechnic, Nagpur
2.	Mr. G. H. Dahole	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
3	Mr. D. J. Ghode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur
4.	Dr. V. M. Athawale	Head of Department, Mechanical Engineering	Government Polytechnic, Yawatmal
5.	Mr. K. S. Thekedar	Lecturer in Mechanical Engineering	Government Polytechnic, Bramhapuri
6.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
7.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
8.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSE
COURSE CODE	: ME412E ^s
COURSE TITLE	: METROLOGY AND QUALITY CONTROL
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 00; TU: 00; PR: 04
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (External)
PT.	: NIL

❖ RATIONALE:

The Diploma mechanical Engineer should have the knowledge of selection and use of various measuring instruments as he often comes across measuring different parameters of machined components and the appropriate fitment of interchangeable components in the assemblies. The knowledge of the subject also forms the basis for the design of mechanical measurement systems, design & drawing of mechanical components.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Illustrate various linear and angular measuring instruments, standards of measurements and system of limits, fits and gauges.
2. Analyze measurements of surface finish, dimensional and non dimensional parameters and gear, screw thread parameters. Inspect components by using dial indicator.
3. Apply various concepts of statistical quality control.
4. Measure different linear and angular dimensions by various instruments.
5. Plot various quality control charts and draw conclusion.
6. Adapt various precautions while taking measurements.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Measure various dimensions & dimensional parameters using instruments such as radius gauge, pitch screw gauge, filler gauge, vernier caliper, vernier height gauge, vernier depth gauge, dial type vernier caliper, micrometer, inside micrometer. Practical also includes following outcomes (Cognitive Domain) - - State Definition of Metrology, - Describe Construction and working of various types of linear measuring instrument.	Introduction	06
2	Set the Adjustable snap gauge GO end and NOGO end for a given dimensions using slip gauges. Practical also includes following outcomes (Cognitive Domain) - - State Concept of limits fits and tolerances, - Describe Hole and shaft basis system, - State Taylors principle of gauge design, - State classification of plug and ring gauges - Describe Slip gauges and its accessories.		04
3	Inspect given components using Dial Test Indicator as a mechanical comparator. Practical also includes following outcomes (Cognitive Domain) - - State Definition of comparator, - State Classification of comparators , - Describe Construction and working of dial indicator as a comparator.		04
4	Check the given component using high pressure Dial type pneumatic comparator. Practical also includes following outcomes (Cognitive Domain) - - Describe Construction and working of pneumatic compactors, - Select different comparators for particular applications. - State advantages and disadvantages of pneumatic comparator.		06

5	Find unknown angle of component using bevel protractor and verify the same using sine bar/ sine center and slip gauges. Practical also includes following outcomes (Cognitive Domain) - • Concept of angular measurement, list of angular measuring instrument, • construction and working of bevel protractor, • sine bar and sine centre.	Angular Measurement	06
6	Measure the angle of component with the Angle Dekkor / Autocollimator using angle gauge. Practical also includes following outcomes (Cognitive Domain) - • Construction and working of Angle Dekkor, Autocollimator, • Concept of angle gauges • Calculate angle on a component.		04
7	Measure screw thread elements by using screw thread micrometer, screw pitch gauge and Verify with the help of profile projector/tool maker's microscope. Practical also includes following outcomes (Cognitive Domain) - • State terminology of screw thread, • Describe construction and working of screw pitch gauge, • Describe construction and working of profile projector and tool maker microscope.		06
8	Measure gear tooth elements by using gear tooth vernier caliper and verify gear tooth profile using profile projector. Practical also includes following outcomes (Cognitive Domain) - • State terminology of gear, • Describe construction and working of gear tooth vernier caliper and profile projector		06
9	Measure surface roughness of turning, milling, shaping, grinding and lapping surfaces using stylus probe roughness measuring instrument. Practical also includes following outcomes (Cognitive Domain) - • Describe Primary and secondary texture, • Define and interpret sampling length, lay, direction of lay, sources of lay, CLA, Ra, RMS, values as per IS3073-1967. • Draw and interpret symbol for designating surface finish on drawing.	Thread and Gear Metrology	04
10	Test lathe machine/drill machine for parallelism, squareness, trueness by Test Dial indicator.	Testing	04

	Practical also includes following outcomes (Cognitive Domain) - - Define parallelism, straightness, squareness, co-axiality, roundness, run out etc., - Describe Alignment testing of machine tools like lathe and drilling machine.	Techniques	
11	Draw the frequency histogram, frequency polygon for given samples. Take minimum 50 readings. And find mean, mode, median. Practical also includes following outcomes (Cognitive Domain) - - State Techniques for recording inspection data like frequency histogram, frequency polygon etc., Define SQC, - Compute mean, median & mode for given population data.	Statistical Quality Control (SQC)	06
12	Draw and interpret X Bar and R Bar Chart by using available inspection data. Practical also includes following outcomes (Cognitive Domain) - - Define control charts, - Classify control chart, X bar & R bar charts, P bar and C charts, - Compute control limits of various control charts - Interpret various control charts		06
Skill Assessment			02
Total Hrs.			64

❖ SPECIFICATION TABLE FOR THEORY PAPER : Nil

❖ QUESTION PAPER PROFILE FOR THEORY PAPER : Nil

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	10	--	Journal & Printouts	1, 2, 3, 4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Skill of performing the practical	20
2	Knowledge of the topic	10
3	Care, Precautions and human error while handling instrument	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	3	3	–	–	3	3	–	3	3	–
2	–	3	3	3	–	–	3	3	–	3	3	–
3	–	3	3	3	–	–	3	3	3	3	3	1
4	–	3	3	3	–	–	3	3	–	3	3	–
5	–	3	3	3	–	–	3	3	3	3	3	–
6	–	3	3	3	–	–	3	3	3	3	3	–

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Metrology and Quality Control	R K Jain, Khanna Publication, Delhi	71-7409-024-X
2.	Engineering Metrology	I. C. Gupta, Dhanpat Rai and Sons Publication.	798-81-89928-45-2

❖ **E-REFERENCES:**

- www.a-zshiksha.com/forum/viewtopic.php?f=148&t=61562, assessed on 17th September 2016.
- www.a-zshiksha.com/forum/viewtopic.php?f=148&t=61562, assessed on 18th September 2016.
- www1.gantep.edu.tr/~bozdana/ME472_5.pdf, assessed on 26th July 2016.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Vernier Calliper, Vernier Height Gauge, Vernier Depth Gauge, Dial type vernier caliper, Micrometer, Inside Micrometer, Tube micrometer, Radius gauge. Pitch screw gauge, Feeler gauge.
- A set of adjustable snap gauges with Go and No Go End, A set of snip gauges, Dial indicator with magnetic stand surface plate,
- High pressure dial type pneumatic comparator,
- Bevel protractor, sine bar, sine centre.
- Angle Dekkor, Autocollimator and set of angle gauges.
- Screw thread micrometer, screw pitch gauge.
- Profile projector.
- Tool makers microscope
- Surface Roughness measuring instrument.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. M. M. Dangre	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. M. S. Deshpande	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. D. J. Ghode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME413E
COURSE TITLE	: MECHANICAL MEASUREMENT
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: NIL
PR. TEE EXAM	: 02 HRs (External)
PT. EXAM	: NIL

❖ RATIONALE:

The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid strides, with many types of instrumentation devices, innovations, refinements. The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non electrical parameters like temperature, pressure, flow rate, velocity, force & stress.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Select instrument for measurement of various measured.
2. Specify different instruments.
3. Draw various practical setups.
4. Operate various instruments.
5. Measure error in measurement.
6. Record the readings of various instruments.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Unit	Hrs.
1.	Identify various measuring instrument in laboratory & write their technical specifications - Select instrument to measure various measurands. - Specify range, span, accuracy, threshold and resolution, of various instruments.	Introduction	2
2	Measure pressure and vacuum using Bourdon tube type gauges. - Select bourdon tube type gauge to measure pressure and vacuum - Specify range, span of bourdon tube type gauges. - Write units of pressure measurement. - Draw constructional features of bourdon tube type gauge. - Measure pressure and vacuum using bourdon tube type gauge.	Pressure measurement	4
3	Measure pressure using U tube manometer. - Draw diagram of U tube manometer, - Inclined manometer, U- tube differential manometer, Inverted U- tube differential manometer. - Compare U tube manometer and inclined manometer. - Measure pressure using U tube manometer.		4
4	Measure temperature using Thermistor. - Compare different temperature scales. - Compare working principle of resistance temperature detector and thermistor. - Draw various shapes of thermistor. - Measure temperature using thermistor.	Temperature Measurement	4
5	Measure temperature using Thermocouple and optical pyrometer. - Compare contact and non contact type of indirect temperature measurement. - Draw basic thermocouple circuit working on Seebeck effect. - Draw constructional feature of optical pyrometer. - Write Laws of thermocouple and their applications. - Measure temperature using thermocouple and optical pyrometer.		4

6	Measure flow rate using Rotameter • Compare various methods of flow measurement. • Draw the diagram of practical set up to measure flow using rotameter. • Draw shapes of float used in rotameter. • Write working principle of rotameter. • Measure flow rate using roatameter and compare with actual flow rate.	Flow Measurement	4
7	Measure flow rate using Venturimeter • Compare flow rate measuring instruments working on constant area variable head concept. • Draw constructional features of Venturimeter. • Write working principle of Venturimeter. • Measure flow rate using Venturimeter.		4
8	Measure strain using strain gauge • Compare various types of Resistance strain gauges. • Draw Wheatstone bridge network to measure strain using strain gauge and write working principle. • Measure strain and plot a graph of Load Vs Strain.	Strain measurement	4
9	Measure displacement using LVDT(Linear Variable Differential Transformer) • Compare LVDT and RVDT(Rotary variable differential transformer) working on mutual inductance concept. • Draw circuit diagram of LVDT to measure linear displacement. • Measure actual linear displacement using micrometer screw gauge and LVDT. • Plot a graph (Displacement measured using micrometer screw gauge Vs Displacement measured using LVDT)	Displacement measurement	4
10	Measure displacement using Inductive transducer • Compare displacement measurement using concept of mutual inductance and self inductance. • Draw circuit diagram of Inductive Transducer to measure displacement. • Measure displacement using inductive transducer.		4
11	Measure Liquid level using Capacitive gauge • Compare various methods to measure liquid level. • Compare effect of change overlapping area, dielectric constant between the plates of capacitor and the distance between the plates of capacitor on capacitance. • Draw practical set up to measure liquid level using capacitive gauge. • Measure liquid level using capacitive gauge and compare it with actual level measurement using linear scale	Level Measurement	4
12	Measure Liquid level using float and shaft gauge • Compare concept of direct & indirect liquid level measurement • Draw practical set up to measure liquid level using float and shaft gauge. • Measure Liquid level using float and shaft gauge		4
13	Measure speed using Stroboscope. • Compare different methods of speed measurement.	Speed Measurement	4

	• Draw practical set up to measure speed using stroboscope. • Put a mark on rotating shaft. • Adjust the flashing light frequency of stroboscope to observe single mark on rotating shaft. • Measure speed using stroboscope.		
14	Measure force using Multi-lever platform scale • Compare different methods of force measurement. • Draw constructional features of Multi-lever platform scale. • Measure force by adjusting poise weight and pan weight.	Force Measurement	4
15	Measure torque using strain gauge torsion meter. • Compare different methods of torque measurement. • Draw practical set up of torque measurement using • Measure torque using strain gauge torsion meter.	Torque Measurement	4
16	Measure shaft power using absorption dynamometer • Compare Absorption, Transmission and Driving Dynamometers for shaft power measurement. • Compare working principle of different types of absorption dynamometer. • Measure shaft power using eddy current dynamometer.	Power Measurement	4
Skill Assessment			2
Total Hrs			64

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	10	--	Journal & Printouts	1, 2, 3, 4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing figure of apparatus, selection of equipment's. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	3	3	–	–	–	3	–	3	3	–
2	–	3	3	3	–	–	–	3	–	3	3	–
3	–	3	3	3	–	–	–	3	3	3	3	–
4	–	3	3	3	–	–	–	3	–	3	3	–
5	–	3	3	3	–	–	–	3	3	3	3	–
6	–	3	3	3	–	–	–	3	3	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	A Course In Mechanical Measurements And Instrumentation	A.K.Sawhney, P.Sawhney, Dhanpat Rai & Sons, 12 th Edition, 2001	8177000233
2.	Mechanical Measurement & Control.	R.V. Jalgaonkar, Everest Publishing House, 18 th Edition, 2010	10:8186314261 13: 978-8186314265
3.	Mechanical & Industrial Measurements.(Process Instrumentation and Control)	R.K. Jain, Khanna Publications, 2011	8174091912
	Instrumentation Devices & Systems	C. Rangan, G Sarma, V.S.V. Mani , McGraw Hill Education; 2 nd Edition, April 2001	10: 0074633503 13: 978-0074633502
5.	Mechanical Measurements & Control.	D.S.Kumar, Metropolitan Publishing Pvt. Ltd. 4 th Edition, 2006.	10: 8120004124 13: 978-8120004122

❖ **E-REFERENCES:**

- http://nptel.ac.in/reviewed_pdfs/112106138/lec1.pdf, assessed on 12th September 2016
- <http://www.slideshare.net/manishsharma225/lecture-no1-ppt>, assessed on 12th September 2016
- <https://drive.google.com/file/d/0BwYLk28fu-Hra28wUmd0VTJSUIU/view>, assessed on 12th September 2016
- <https://www.youtube.com/watch?v=lc4dsNvm2Ks>, assessed on 12th September 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. LVDT Measurement Trainer (Sensor range +/- 10.0mm, Linearity 1%)
2. Thermister Trainer (100 degree centigrade, Temperature source –Water kettle, Initial and Final Set – Through single turn Potentiometer)
3. Rota meter(Range 0-50 LPM)
4. Capacitance Level Trainer(Range 0-500 mm, Least count +/- 1mm,Medium –Water)
5. Thermocouple Iron – Constantan (0⁰c to 482⁰c), Limits of error ± 2.2 °C.
6. Stroboscopic flash rate 100 to 15000 flashes per minute, Accuracy $\pm 0.05\%$.
7. Torsion meter (Range 10 Nm to 100 Nm), drive rotation speed 1 to 20r/min.
8. Eddy current Absorbing dynamometer, Max speed 6000 RPM, Peak absorbing torque 1092 Nm at 1000 –1500 rpm.
9. Optical Pyrometer - Accuracy $\pm 0.5\%$ of Reading, Temperature ranges 1420°F – 5800°F (770°C - 3200°C).

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R. R. Chaudhari	Head of Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. A. V. Abhyankar	Lect Mech Engg	Government Polytechnic, Nagpur.
3.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
4.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
5.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: ME414E ^s
COURSE TITLE	: INDUSTRIAL PROJECT
PREREQUISITE	: 100 credits
TEACHING SCHEME:	TH: 00; TU: 00; PR: 04(CLOCK Hrs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (External)
PT.	: NIL

❖ RATIONALE:

Industrial project course is the manifestation of technical knowledge acquired by the student during their course of work. This course provides an opportunity to the students to identify and solve real life problem of the industries /research organization / society. Students also get opportunity to provide innovative, economic and technological viable solution to the world of work.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

- 1 Select possible project work through survey.
- 2 Develop method of commencement of project work
- 3 Analyze feasibility using analysis tools
- 4 Design and plan for fabrication and testing of project
- 5 Compose report of process and procedure of fabrication of project
- 6 Demonstrate and justify the outcome of project work

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Perform introductory Task - Form project batch of four-five students - Select project as per area of interest - Select topic / industrial problem / work by consulting the guide from following list - Innovation - Design & Fabrication - Improvement in Equipment - Maintenance - Repairs - Any recent topic related to mechanical engineering Perform Literature Survey - Refer various Periodicals, Journals, Books, Internet literature related to project topic - Note down findings - Prepare database of collected literature on the basis of title, area of work, methodology used, type of work - Analyze industrial need - Prepare brief report	Introductory Task and Literature Survey	10
2	Plan project - Prepare Synopsis in standard format which includes following. Title Page: Project Title, Purpose of submission, Institute logo, Students Name, Guide Name, Department and Institute Name - Use Latex for preparing synopsis. - Submit the Synopsis to guide. - Approve synopsis from guide - Prepare action plan of project activities - Submit the action plan to guide. - Approve action plan from guide	Planning	10
3	Perform Project work - Design a project - Fabricate the same	Project Work	15
4	Test Project work	Testing	15

5	Prepare project report in standard format, which includes following. - Title Page which includes: Project Title, Purpose of submission, Institute logo, Students Name, Guide Name, Department 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 - Introduction, objectives - Literature Survey - Methodology/Materials/Methods/Estimate. - Results - Summary/Conclusion. - References Use Latex for preparing report. Perform plagiarism check from free internet site. - Submit report of plagiarism check to the guide with project report	Project Writing	10
6	Present project work - Prepare power point presentation of work done. - Prepare yourself to handle examiner questions after presentation. - Practice group presentation. - Present before guide.	Presentation	4
		Total	64

❖ SPECIFICATION TABLE FOR THEORY PAPER : Not Applicable

❖ QUESTION PAPER PROFILE FOR THEORY PAPER : Not Applicable

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Rubrics, Assessment Sheets & Project work done	1, 2, 3, 4,5,6
		Writing		Continuous	10	--	Project Report	1, 2, 3, 4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	100	40	Rubrics & Project Report and work done	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of topic	10
2	Literature survey	10
3	Project planning and implementation	10
4	Work done, Feasibility of work, Results	50
5	Report writing	10
6	Presentation of work and viva voce	10
Total		100

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	3	3	–	3	–	–	–	–
2	–	3	3	–	3	3	3	3	–	–	3	–
3	–	3	3	3	3	3	3	3	–	–	3	3
4	–	3	3	3	–	–	3	3	3	3	3	3
5	–	3	–	3	–	–	–	3	3	3	3	3
6	–	–	–	–	–	–	3	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Models & Methods for Project Selection	Graves, Samuel B., Ringuest, Jeffrey L, International Series in Operations Research & Management Science Volume 58 2003	978-1-4615-0280-7
2	R and D Project Selection	Joseph P. Martino, Wiley series in Engineering and Technical Management	978-0471595373

❖ **E-REFERENCES:** Nil

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

- As per requirement of project

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R. R. Chaudhari	Head of Department, Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. A. R. Sheikh	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Dr. S. W. Rajurkar	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
4.	Mr. G. V. Gotmare	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
5.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
7.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/MT/PK/TX

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : SE401E

COURSE TITLE : SEMINAR

PREREQUISITE : 60 Credits

TEACHING SCHEME: TH:00; TU:00;PR: 02(CLOCK Hrs.)

TOTAL CREDITS : 01(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE EXAM : NIL

PR. TEE EXAM : 02 HRs (Internal)

PT. EXAM : NIL

❖ **RATIONALE:**

Seminar course is the manifestation of soft skills acquired by the student during their course of work. This course provides an opportunity to develop and present their own technical knowledge, communication skills, presentation skills, self-learning abilities, creativity, and team working abilities. This course will also enable them to gain confidence to face the world of work.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

- 1 Select seminar topic
- 2 Carryout Literature survey
- 3 Prepare planning
- 4 Prepare seminar report
- 5 Prepare seminar presentation
- 6 Present interpersonal skills, presenting skills, soft skills and creativity.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Perform introductory Task - Select seminar topic individually as per area of interest - Select recent technical topic, not covered in curriculum, by consulting the guide.	Topic Selection	2
2	Perform Literature Survey - Refer various Periodicals, Journals, Books, Internet literature related to seminar topic - Note down findings - Prepare brief report	Literature Survey	6
3	Plan Seminar - Prepare outline of selected seminar topic in standard format - Approve seminar topic from guide - Prepare action plan of work - Submit the action plan to guide. - Approve action plan from guide	Planning	2
4	Prepare seminar report in standard format, which includes following. - Title Page which includes: Seminar Title, Purpose of submission, Institute logo, Students Name, Guide Name, Department and Institute Name - Certificates: Student declaration, Certificate from guide - Acknowledgement - Text - Introduction - Literature Survey - Methodology/Materials/Methods - Results - Summary/Conclusion. - References Use Latex for preparing report. Perform plagiarism check from free internet site. - Submit report of plagiarism check to the guide with seminar report	Report Writing	12
5	Prepare power point presentation Prepare yourself to handle audience / examiner questions after presentation. Practice presentation before group of students	Preparation	08
6	Present before guide Present before assessment panel.	Presentation	02
Total Hrs.			32

- ❖ **SPECIFICATION TABLE FOR THEORY PAPER:** Not Applicable
- ❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:** Not Applicable
- ❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Rubrics, Assessment Sheets & Seminar Report	1,2,3,4,5,6
		Report Writing		Continuous	10	--	Seminar Report	1,2,3,4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics, Seminar Report & Presentation	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of topic	05
2	Literature survey	05
3	Project planning and implementation, Work done, Feasibility of work	05
4	Report writing	05
5	Presentation Skills	25
6	Viva voce	05
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSO	PSO
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	3	3	–	–	–
2	–	3	3	3	–	–	3	3	3	3	–	–
3	–	3	3	3	–	–	3	3	3	3	–	–
4	–	3	3	3	–	–	3	3	3	3	–	–
5	–	3	3	3	–	–	3	3	3	3	–	–
6	–	–	–	–	–	–	–	3	3	3	–	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	The Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any Audience	Carmin Gallo, McGraw-Hill Education, 1 st Edition, October 2009	10: 0071636080 13: 978-0071636087
2.	Speaking Your Mind: Oral Presentation and Seminar Skills	Rebecca Stott, Tory Young, Cordelia Bryan, Longman, 2001	0582382432, 9780582382435
3.	How to Design TED-Worthy Presentation Slides: Presentation Design Principles from the Best TED Talks	Akash Karia, Create Space Independent Publishing Platform, 3 rd Edition, February 2015	10: 1507638124 13: 978-1507638125
4.	Presenting with Credibility: Practical Tools and Techniques for Effective Presentations	Bruna Martinuzzi, Six Seconds Emotional Intelligence Press, Kindle Edition, April 2012	978-1-935667-12-4

❖ **E-REFERENCES:**

- http://www.prepareforsuccess.org.uk/skills_for_presenting_in_seminars.html , accessed on 5th November, 2016
- <http://www.che.iitb.ac.in/faculty/jb/courses/seminar/tips.html> , accessed on 5th November, 2016
- <https://www.youtube.com/watch?v=dEDcc0aCjaA> , accessed on 5th November, 2016
- <https://www.youtube.com/watch?v=V2q7Q2j7ESs> , accessed on 5th November, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. DLP Projector, latest specification
2. Computer, latest specification

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. S. W. Rajurkar	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
2.	Mr. G. V. Gotmare	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/MT/PK/TX

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : ID401E

COURSE TITLE : INDUSTRIAL TRAINING

PREREQUISITE : 70 Credits

TEACHING SCHEME: TH: 00; TU: 00; PR: 02(CLOCK Hrs.)

TOTAL CREDITS : 01(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE : NIL

PR. TEE : 02 HRs (Internal)

PT. EXAM : NIL

❖ **RATIONALE:**

The aim of the polytechnic education is to create a pool of skill based manpower to support shop floor and field operations as a middle level link between technicians and engineers. Diploma pass out plays an important role in managing shop-floor operations. Therefore, it is necessary to the diploma pass out to get acquainted with the actual shop floor operations in the industry. This course has been designed to give actual working environment exposure to the diploma students.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

- 1 Adhere industrial safety practices
- 2 Work in industrial working environment.
- 3 Carry out survey related to industrial processes.
- 4 Identify industrial problems for industrial Project Course
- 5 Prepare industrial training report based on work experience
- 6 Present report

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Adhere Industrial Safety Practices - Talk to safety officer - Record the safety practices to be followed in industry. - Record Don'ts and Do's. - Follow all instructions.	Safety Practices	04
2	Perform Industrial Process Survey - Collect information regarding various processes carried out in an industry by discussing the allotted supervisor/officer - Note down findings - Prepare brief report	Survey	06
3	Work in industrial working environment - Follow instructions of supervisor - Observe industrial processes - Record daily work done in diary	Working Experiences	18
4	Identify industrial problems - Discuss with the supervisor and workers - Identify the problem in any of the industrial process/system - Record your findings	Problem Identification	04
5	Prepare industrial training report in standard format, which includes following. - Title Page which includes: Title, Purpose of submission, Institute logo, Students Name, Industry Name, Department and Institute Name - Certificates: Student declaration, Certificate from industry - Acknowledgement - Text - Introduction to Industry - Safety Practices in Industry - Industrial Process - Working Experience - Results - Summary/Conclusion. - References Use Latex for preparing report. Perform plagiarism check from free internet site. - Submit report of plagiarism check to the allotted teacher with industrial training report	Report Writing	After Completion of Training
6	Prepare power point presentation Present before panel of teachers.	Presentation	
Total Hrs.			32

- ❖ **SPECIFICATION TABLE FOR THEORY PAPER:** Not Applicable
- ❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:** Not Applicable
- ❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Rubrics, Assessment Sheets & Report	1,2,3,4,5,6
		Report Writing		Continuous	10	--	Report	1,2,3,4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics, Report & Presentation	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of industry/ industry supervisor's remark	05
2	Survey	05
3	Work done and Feasibility of work/ problem identified	15
4	Report writing	15
5	Presentation Skills	05
6	Viva voce	05
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	3	2	2	2	-	-	3	3	3	-	-
2	-	3	2	2	2	-	-	3	3	3	-	-
3	-	3	-	-	-	-	-	3	3	3	-	-
4	-	3	-	-	-	-	3	3	3	3	-	-
5	-	3	-	-	-	-	3	3	3	3	-	-
6	-	3	-	-	-	-	3	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

- <http://ihmshimla.org/wp-content/uploads/2013/05/Industrial-Training-Rule-Book.pdf>, assessed on 25th September, 2016

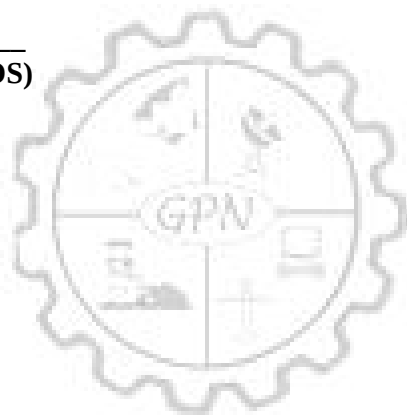
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- DLP Projector, latest specification
- Computer, latest specification

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. S. W. Rajurkar	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
2.	Mr. G. V. Gotmare	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/MT/PK/TX

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : ID402E

COURSE TITLE : INDUSTRIAL PRACTICES

PREREQUISITE : 70 Credits

TEACHING SCHEME : TH:00; TU:00;PR: 02(CLOCK Hrs.)

TOTAL CREDITS : 01(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE EXAM : NIL

PR. TEE EXAM : 02 HRs (Internal)

PT. EXAM : NIL

❖ RATIONALE:

The aim of the polytechnic education is to create a pool of skill based manpower to support Construction site and field operations as a middle level link between technicians and engineers. Diploma pass out plays an important role in managing Construction site operations Therefore, it is necessary to the diploma pass out to get acquainted with the actual Construction site operations in the Construction industry. This course has been designed as an optional course to industrial training to give actual working environment exposure to the diploma students, through virtual industry in class room.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

- 1 Visit industries.
- 2 Get acquainted with industrial safety practices through videos and industrial experts.
- 3 Carry out survey related to industrial processes.
- 4 Explore industrial working environment through videos and industrial experts.
- 5 Identify industrial problems for industrial Project Course discussing with industrial experts.
- 6 Prepare and present report based on virtual industrial exposure and industrial visit.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Visit any two industries related to program. Small scale, medium scale, large scale and perform task given in following point 2 to 5.	Industrial Visits	18
2	Get acquainted with industrial safety practices - Observe Video and listen industrial experts - Talk to industrial experts - Record the safety practices to be followed in industry. - Record Don'ts and Do's.	Safety Practices	02
3	Carryout survey related to industrial processes - Observe Video and listen industrial experts - Collect information by discussing with industrial experts - Note down findings - Prepare brief report	Survey	02
4	Explore industrial working environment - Observe Video and listen industrial experts - Observe industrial processes - Note down findings	Working Experiences	08
5	Identify industrial problems - Discuss with industrial experts - Identify the problem in any the industrial process/system - Record your findings	Problem Identification	02
6	Prepare and present report in standard format, which includes following. - Title Page which includes: Title, Purpose of submission, Institute logo, Students Name, Industry Names, Department and Institute Name - Certificates: Student declaration - Acknowledgement - Text - Introduction to Industry - Safety Practices in Industry - Industrial Process - Results - Summary/Conclusion. - References Use Latex for preparing report. Perform plagiarism check from free internet site. - Submit report of plagiarism check to the allotted teacher with industrial training report	Report Writing	Home Assignment
6	Prepare power point presentation Present before panel of teachers.	Presentation	
Total Hrs.			32

- ❖ SPECIFICATION TABLE FOR THEORY PAPER: NIL
- ❖ QUESTION PAPER PROFILE FOR THEORY PAPER: NIL
- ❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	40	--	Rubrics, Assessment Sheets & Report	1,2,3,4,5,6
		Report Writing		Continuous	10	--	Report	1,2,3,4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics, Report & Presentation	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of industry/ industry supervisor's remark	05
2	Survey	05
3	Work done and Feasibility of work/ problem identified	15
4	Report writing	15
5	Presentation Skills	05
6	Viva voce	05
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	3	2	2	2	-	-	3	3	3	-	-
2	-	3	2	2	2	-	-	3	3	3	-	-
3	-	3	-	-	-	-	-	3	3	3	-	-
4	-	3	-	-	-	-	3	3	3	3	-	-
5	-	3	-	-	-	-	3	3	3	3	-	-
6	-	3	-	-	-	-	3	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

- <http://ihmshimla.org/wp-content/uploads/2013/05/Industrial-Training-Rule-Book.pdf>, assessed on 25th September, 2016

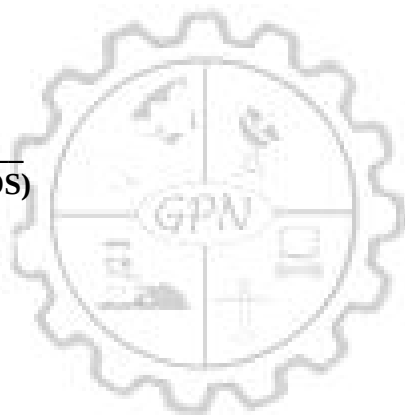
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- DLP Projector, latest specification
- Computer, latest specification

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. S. W. Rajurkar	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
2.	Mr. G. V. Gotmare	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.

(Member Secretary PBOS)



(Chairman PBOS)

LEVEL - V

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: ELECTIVE COURSE
COURSE CODE	: ME501E ^s
COURSE TITLE	: RENEWABLE ENERGY SOURCES
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 04; TU: 00; PR: 02
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (External)
PT.	: 01 HR

❖ RATIONALE:

The conventional energy resource is limited in nature and will be exhausted in future. A day is not far off when major demand will be met by non-conventional energy sources at less unit cost of production. World is emphasizing on the power generated by non-conventional energy sources. It is expected that mechanical technicians will assist in erecting, planning and commissioning these power plants. Therefore knowledge of non-conventional energy sources is very essential.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Enumerate different forms of renewable energy.
2. Apply the principles of different renewable energy sources for energy generation
3. Select proper renewable energy sources for energy generation.
4. Install energy conversion system.
5. Measure energy input of different forms of energy.
6. Select proper energy conversion system based on input data.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Solar Energy	1. State basic principle of measurement of solar radiation. 2. State methods of conversion of solar energy in to heat. 3. List components of photo voltaic street light system. 4. Compare different types of solar energy collector 5. Describe the construction of different solar energy collectors 6. Justify, the selection different solar collectors for specific application 7. Justify, the selection PV panels	1.1 Basic principles of solar radiation measurement, solar radiation data, estimation of average solar radiation. 1.2 Solar energy collectors, principle of conversion of solar radiation into heat, flat plate collectors, concentrating collectors, focusing type, comparison between flat plate and concentrating collector, basic principles & application only. 1.3 Solar energy storage systems, thermal, electrical, chemical, mechanical, electromagnetic energy storage, solar pond and its applications. 1.4 Photo Voltaic-Phenomenon, and power plant considerations 1.5 Applications of PV systems.	12
2. Energy From Biomass	1. Identify components of Janta bio gas plant. 2. State relative advantages and disadvantages of biogas plants Describe basic principle of Biomass conversion. 3. Analyse the factors affecting bio-generation of gas. 4. Describe the construction of biogas plant 5. Analyse the factors affecting the maintenance of biogas plant. 6. Compare biogas with other gaseous fuel 7. Justify the selection of biogas as a fuel in rural area.	2.1 Basic principles of Biomass conversion, Photosynthesis, biogas generation, factors affecting bio-generation of gas. 2.2 Classification of biogas plants, advantages & disadvantages of floating dome and fixed dome type plant. 2.3 Types of biogas plants, Constructional details of Gobar gas generator, Janta biogas plant, and community biogas plants 2.4 Constituents of biogas, properties, comparison of biogas with other gaseous fuels	10
3. Ocean Energy	1. State types of ocean energy technologies 2. Describe types of OTEC power plants. methods 3. Compare different types of OTEC technologies 4. Describe operation of tidal power plant. 5. Compare various types of tidal	3.1 Types of ocean energy technologies 3.2 Methods of ocean thermal electric conversion (OTEC) power generation, open and closed cycle. 3.3 Principles of tidal power, components of tidal power plant, operation, methods of	10

	power plants 6. Justify the selection criteria of tidal power plant. 7. State different methods of ocean wave conversion	utilization of total energy, single basin tidal and double cycle system. 3.4 Ocean wave Energy methods, Wave energy Conversion by floats in to electric energy. 3.5 Prospects of ocean energy power plants in INDIA	
4. Wind Energy	1. Define various terms related to wind power 2. State Betz's Law 3. Describe various principle of wind energy conversion. 4. State potential values of wind speed for energy generation 5. Classify wind energy conversion systems. 6. Describe the types of WPP. 7. State advantages and disadvantages of wind energy conversion. 8. Justify selection of WPP site. 9. Justify the controls of WPP.	4.1 Wind Energy Basic, Power in wind- power density, energy content Annual mean wind speed and its potential value, Betz's Law, Principle of wind energy conversion- Drag and Lift principle 4.2 Wind Power Plant (WPP)- Site selection criteria, Classification of WPP, Wind Machines-Horizontal axis machines, Vertical axis machines Components of WPP, Necessity of speed control of wind turbine, Methods of control of WPP- Yaw control, pitch control 4.3 Prospects of wind power plants in INDIA	10
5. Other Forms of Energy.	1. Define geothermal source, hydrothermal resource vapour and liquid dominated system. 2. Describe principle of operation of geothermal energy conversion system. 3. State necessity of hydrogen as a fuel 4. Compare hydrogen with other fuel 5. Justify, the hydrogen as green fuel 6. Describe various methods of hydrogen production 7. Describe construction and operation of H_2 - O_2 Fuel cell.	<u>Geothermal energy</u> 5.1 Nature of geothermal fields, geothermal sources, hydrothermal resources, vapour and liquid dominated systems, binary cycle. 5.2 Geo-pressure resources, hot dry rock, magma-resources, 5.3 Prime movers for geothermal energy conversion. <u>Chemical Energy</u> 5.4 Hydrogen energy-Merits of hydrogen over other fuels Comparison of hydrogen properties with Petrol Gasoline, Methane, Methanol 5.5 Different methods of hydrogen production, Electrolysis of water- Fundamentals of Electrolysis, chemical reaction, Electrolysis Methods- Tank type Electrolyzer, Bipolar electrolyzer Description, advantages and limitations. 5.6 Hydrogen storage- Necessity and methods, their description, advantages and limitations.	12

		5.7 Principle of operation of a H ₂ -O ₂ fuel cell, advantages and disadvantages of fuel cells, conversion efficiency, applications of fuel cells.	
6. Hydro energy.	1. Draw layout of Hydroelectric power plant. 2. State function of components of Hydroelectric power plant. 3. Justify the site selection of micro hydro power plant 4. Compare features of hydroelectric power plant with other.	6.1 Classification of hydro power plants, based on head and capacity 6.2 Layout of Hydroelectric Power plant, and concept of Micro Hydel Power plant. Its need. Hydroelectric potential in India. 6.3 Principle of working of hydroelectric power plant., and Its components. 6.4 Site selection for micro hydroelectric power plant. Selection criteria for hydraulic turbine. 6.5 Comparison of operational and maintenance cost of hydroelectric power plant with Thermal power plant	10
			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Install solar water heater and write report.	Solar Energy	2
2	Dismantle and assemble Janta bio gas plant model and state precautions for use. OR Prepare a visit report on biogas plant or Prepare a report on biogas Plant by observing video CD.	Energy From Biomass	2
3	Prepare report on different types of ocean energy based power plant in India.	Ocean Energy	2
4	Measure wind velocity and select suitable wind mill.	Wind Energy	2
5	Identify different components of wind Power Plants		2
6	Prepare a visit report on wind power plant or Prepare a report on Wind Power Plant by observing video CD.		2
7	Gather information about Micro Hydroelectric power plants in India,	Hydro energy	2
8	Prepare a visit report on Micro Hydro electric power plants in India or Prepare a report on Micro Hydro electric power plants by observing video CD.		2
Skill Assessment			2
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Solar Energy	02(02)	10(00)	00(06)	12(08)
02	Bio-mass Energy	02(04)	04(04)	06(00)	12(08)
03	Tidal Energy	06(00)	06(04)	00(06)	12(10)
04	Wind Energy	02(00)	06(04)	04(00)	12(04)
05	Other forms of Energy	08(00)	04(04)	00(00)	12(04)
06	Hydraulic Energy.	00(02)	00(04)	10(00)	10(06)
	Total	20(08)	30(20)	20(12)	70(40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	3	R	2	4	R	2	3	U	2	1	R	2	5/7
	6	R	2																
02	1	U	4	2	U	4	3	R	4	2	R	4	2	U	4				3/5
03	3	U	4	6	A	4	4	A	4	3	U	4	4	U	4				3/5
04	5	R	4	5	R	4	5	U	4	5	U	4	6	U	4				3/5
05	1	U	6	2	A	6	1	A	6										2/3
06	4	U	6	6	A	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Procedure sequence, relevant information collection, measurement of wind velocity	20
2	Record and Presentation	20
3	Summary of write-up	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	3	3	–	–	–	3	–	–
2	–	3	–	–	–	3	–	–	–	3	–	–
3	–	3	–	–	3	3	–	–	–	3	–	–
4	–	3	2	–	–	3	–	2	2	3	2	–
5	–	3	2	–	–	3	–	2	2	3	2	–
6	–	3	2	–	–	3	–	2	2	3	2	–

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Non-conventional Energy Sources	G.D. Rai, Standard Publishers Distributors.	8186308296
2.	Power Plant Engineering	Arora and Domkundwar. Dhanpat Rai & co.	0-07-084175-6
3.	Solar Energy	S.P. Sukhatme, Tata McGraw-Hill Education, 1996.	0074624539
4.	Renewable Energy Sources and Emerging Technologies	D. P. Kothari, K. C. Singal, Rakesh Ranjan, PHI Learning Pvt. Ltd., 2 nd Edition, 2015	978-81-203-4470-9
5.	Renewable Energy Technologies- A Practical guide for beginners	Chetan Singh Solanki, PHI Learning Pvt. Ltd., First, 2008.	978-81-203-3434-2
6.	Solar Photovoltaic Technology and System: A Manual for Technicians, Trainers and Engineers	Chetan Singh Solanki, PHI Learning Pvt. Ltd., 5 th Edition, 2016	978-81-203-4711-3

❖ **E-REFERENCES:**

- <http://www.hotwater.com/lit/im/solar/320009.pdf> for solar water heater installation

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Solar Photovoltaic Training Kit prepared by IIT, Mumbai
- Mono-crystalline Solar PV module, 50Wp
- Poly- crystalline Solar PV module, 50Wp
- Wind Turbine 1 Kw with all accessories
- Wind turbine models
- Solar water heating system models
- Biogas Models
- Models of various power transmission drives

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. A. R. Sheikh	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Mr. M. S. Deshpade	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. O. V. Sarode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: ELECTIVES COURSES
COURSE CODE	: ME502E ^s
COURSE TITLE	: INDUSTRIAL AUTOMATION
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02
TOTAL CREDITS	: 05(1TH/TU CREDIT=1CLOCK HR,1PR CREDIT=2 CLOCK HR.)
TH.TEE	: 03 Hrs
PR.TEE	: 02 Hrs (External)
PT	: 1 Hr

❖ RATIONALE:

This course is classified under Professional Electives. This course describes the basic facts, concepts & principles of automation, which are commonly used in industry.

Automation is need of industry which leads to fulfill the changing demand of customer. Hence, this course will develop various ideas to develop automation system and diagnose various real time problems in automation industry.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify potential areas for automation.
2. Identify various basic elements of automated system
3. Select suitable major control components required to automate a process or an activity
4. Diagnose the faults in automation
5. Identify suitable automation hardware for the given application.
6. Identify various automated processes, machines and equipment during industrial visit.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Automation	1. Define Automation 2. List the various types of automation 3. State the basic elements of automated system. 4. Describe the use of various safety monitoring functions 5. State causes and remedies of various faults in automated system	1.1 Basic Concept of Automation • Need for Automation, • Types of Automated Manufacturing systems – Fixed, Programmable, Flexible Automation, • Advantages and Limitations of Automation 1.2 Basic Elements of an Automated system • Power to accomplish the Automated Process • Program of Instructions • Introduction to Control systems 1.3 Advanced Automation Functions • Safety Monitoring • Maintenance and repair diagnostics • Error Detection and recovery	12
2. Control Technologies in Automation	1. List the various types of control systems. 2. Select between time & event driven control system 3. Compare various computer process control system 4. Select control system for particular applications.	2.1 Continuous control system – regulatory control, feed forward control, adaptive control 2.2 Discrete Control system - event driven, time driven 2.3 Forms of Computer process control – computer process monitoring, direct digital control, supervisory control, distributed control system	12
3 Automation in material handling system	1. State role of various material handling systems in automation 2. Describe the technology used in AGV. 3. List the types of conveyors 4. Select the material handling system for particular automation system	3.1 Automated guided vehicle systems • Types of vehicles and AGVs applications • Vehicle guidance technology • Vehicle Management and safety 3.2 Monorails and other rail guided vehicles 3.3 Conveyor system • Types of conveyors • Conveyor operations and features 3.4 Cranes and hoist	12

4. Automatic data capture	1. List the various Automatic Identification methods 2. State the concept of the various Automatic Identification methods 3. Select the data capture system for particular application.	4.1 Overview of Automatic Identification methods • Bar Code Technology • Linear bar codes(one dimensional) • Two-Dimensional bar codes 4.2 Other Automatic data capture technologies • Magnetic strips • Optical character recognition	10
5. Automated production systems	1. State the various system configurations used in automated production lines 2. Describe the mechanism of linear transfer and rotary indexing 3. State the types of assembly systems used in automation 4. List the applications of Automated production line & assembly system. 5. Select the type of assembly system is required in automobile industry.	5.1 Fundamentals of automated production lines ▪ System configurations – in-line & rotary configurations ▪ Work part Transfer Mechanisms- Linear transfer, Rotary indexing. 5.2 Application of automated production lines 5.3 Automated assembly systems ▪ Type of assembly systems ▪ Applications (no numerical)	10
6. Automation in inspection	1. Define off-line and on-line inspection 2. Differentiate between Product inspection and process monitoring 3. Select the inspection techniques for particular application. 4. State concept of to Coordinate Measuring machine , Machine Vision	6.1 Introduction • off-line and on-line inspection • Product inspection and process monitoring • Distributed inspection and final inspection 6.2 Contact and noncontact inspection techniques 6.3 Conventional measuring and gauging techniques 6.4 Introduction to Coordinate Measuring machine , Machine Vision	08
Total			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Diagnose the faults in any one automated system	Introduction to automation	6
2	Identify different control systems used in automated system.	Control technologies in automation	4
3	Prepare a visit report on function various automated material handling equipments in industry	Automation in material handling system	4
4	Conduct case study on the data capturing technique and analyze the data.	Automatic data capture	4
5	Calculate the time required to manufacture a part / assemble a job in automation industry.	Automated production system	6
6	Measure various dimensions of given job using CMM or any other automated gauging system	Automation in inspection	6
Skill Assessment			2
Total			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to automation	04(02)	08(04)	00(00)	12(06)
02	Control technologies in automation	04(00)	04(06)	04(00)	12(06)
03	Automation in material handling system	00(00)	08(04)	04(06)	12(10)
04	Automatic data capture	02(00)	04(04)	06(00)	12(04)
05	Automated production system	00(02)	06(00)	06(04)	12(06)
06	Automation in inspection	00(00)	06(04)	04(04)	10(08)
	Total	10(04)	36(22)	24 (14)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	2	R	2	4	R	2	1	R	2	5/7
	5	R	2																
02	3	U	4	1	U	4	1	U	4	1	U	4	3	U	4				3/5
03	2	U	4	2	A	4	3	A	4	5	A	4	4	U	4				3/5
04	6	A	4	3	U	4	4	U	4	6	A	4	6	U	4				3/5
05	5	U	6	6	U	6	2	U	6										2/3
06	4	A	6	5	A	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing diagrams of machining set up, assembly line, equipments, selection of equipment's. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	–	–
2	–	3	–	–	–	–	–	–	–	3	3	–
3	–	3	–	–	–	3	–	–	–	3	3	–
4	–	3	2	–	–	3	–	2	2	3	3	–
5	–	3	2	–	–	3	–	2	2	3	3	–
6	–	3	2	–	–	3	–	2	2	3	3	–

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Automation, Production Systems and Computer Integrated Manufacturing	M.P. Groover, Pearson Education, 3rd Edition, 2007	100132393212
2.	Industrial Automation	David W. Pessen, John Wiley and Sons, edition 1989	9780471600718
3.	Computer Based Industrial Control	Krishna Kant, PHI Learning Pvt. Ltd. 2 nd Edition, 2010	9788120339880
4.	Performance Modeling of Automated Manufacturing Systems	Viswanandham N, PHI Learning Pvt. Ltd. International Edition. 2009	9788120308701

❖ **E-REFERENCES:**

- 1) [http://nptel.ac.in/courses/108105063/pdf/L-01\(SM\)\(IA&C\)%20\(\(EE\)NPTEL\).pdf](http://nptel.ac.in/courses/108105063/pdf/L-01(SM)(IA&C)%20((EE)NPTEL).pdf) , assessed on 4th August, 2016
- 2) <http://nptel.ac.in/downloads/108105063/> , assessed on 4th August, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Automated guided vehicle – Automatic load transfer, wire guided/laser guide, load capacity at least 5kg, height at least 2ft, speed at least 5mm/sec
2. Coordinate measurement machine- Measuring Volume at least 500mm x 400mm x 440mm, accuracy – 0.1□m, PC control, bechtop/portable, Probe/Sensors – Touch type
3. Data capturing machine - bar code/optical character recognition
4. Model of Automated processing plant – bottling plant in Mechanical Engineering Lab

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Prof. A. R. Sheikh	Lecture, Mechanical Engineering	Government Polytechnic, Nagpur.
2.	Prof. D. J. Ghode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Prof. R. A. Gadekar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: ME503E^s
COURSE TITLE	: HEAT TRANSFER
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02 (CLOCK HR)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT=2 CLOCK HR.)
TH. TEE	: 03 HR
PR. TEE	: 02 HR (External)
PT. EXAM	: 01 HR

❖ RATIONALE:

This course is classified under Professional Electives. The basic principles of heat transfer shall help students to solve problems related to heat transmission in the process.

Heat transfer plays vital role in refrigeration, power plant engineering, automobile engineering and process industries. They are considered as most common elements that come across to mechanical engineers in different industries.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply convection and radiation phenomenon to different mechanical systems that affects the environment
2. Solve conduction problems encountered in practical field.
3. Analyze the heat transfer rate through composite slab.
4. Determine thermal conductivity of various materials.
5. Compute the efficiency and effectiveness of fins.
6. Use various heat exchangers in industrial/domestic applications.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Heat transfer	1. Define Heat transfer 2. State the principle of different modes of heat transfer. 3. State various laws of Heat transfer 4. Describe the concept of electrical analogy with heat transfer	1.1 Modes of Heat Transfer and its effect on environment 1.2 Fourier's law of Heat conduction 1.3 Definition and Expression for thermal conductivity 1.4 Newton's Law of cooling for convection 1.5 Stefan Boltzman's law of Radiation 1.6 Electrical Analogy with Heat Transfer 1.7 Concept of Thermal resistance	8
2. Steady State conduction	1. Define thermal diffusivity 2. Calculate the heat flow rate through slab, cylinder, and sphere. 3. State the equation for overall heat transfer coefficient for slab 4. Describe the concept of unsteady state conduction. 5. Differentiate between steady and unsteady state of heat conduction	2.1 Three dimensional Fourier conduction equation in Cartesian coordinate and Concept of thermal diffusivity (no derivation) 2.2 Heat flow through single Slab 2.3 Heat flow through Composite slab (two layers) 2.4 Heat flow through hollow cylinders (single layer) 2.5 Heat flow through Sphere (single layer) 2.6 Overall Heat Transfer coefficient for slab (two layers) – definition, equation (numerical to calculate heat flow rate, overall heat transfer coefficient and temperatures on all above topics) 2.7 Concept and application of unsteady state of heat conduction	12
3. Heat transfer through Fins	1. Define various terms related to fins 2. State different types of fins. 3. State the application of fins 4. Determine the heat dissipation from various types of fins. 5. Compute fin efficiency and fin effectiveness 6. Interpret the meaning of term used in various formulae of fin.	3.1 Introduction – Definition, Need, Types of fins, applications 3.2 Heat transfer through finite fin 3.3 Heat transfer through fin insulated at the tip 3.4 Heat transfer through infinite long fin 3.5 Efficiency and Effectiveness of fin	10
4 Convection	1. Describe the principle of Natural convection and force	4.1 Free (or Natural) convection 4.1.1 Principle of Natural convection	12

	convection - Define various non dimensional numbers - State the various applications of Natural convection and force convection - Determine the heat transfer coefficient in Natural convection and force convection - Compare Natural convection and force convection	and its applications - Dimensionless numbers – Grashoff Number, Prandtl Number, Nusselt Number - Equations for free convection from flat plate (Numerical to calculate heat transfer coefficient and heat flow rate by using given equation) - Forced convection - Principle of Forced convection and its application. - Dimensionless numbers – Reynold Number, Prandtl Number, Nusselt Number - Equations for force convection from flat plate (Simple Numerical by using given equation) - Combined free and forced convection. – Principles of working - Comparison between Natural convection and force convection	
5. Radiation	- Draw Electromagnetic spectrum to indicate Thermal Radiation - Justify the relation between reflectivity, transitivity and absorptivity - State different radiation properties - Describe the concept of black body and grey body - State the various laws of radiation - State the effect of radiation shield on heat transfer. - Calculate the heat flow rate between two surfaces.	- Thermal Radiation in Electromagnetic spectrum, - Radiation properties such as reflectivity, transmittivity and absorptivity, - Emissive properties – Emissive power, emissivity, monochromatic emissive power, monochromatic emissivity - Concept of Specular and diffuse radiation - Concept of black and grey body - Laws Radiation – Planks law, Kirchoffs law, Wein Displacement law, Stefan Boltzman law - Radiation from Real surfaces - Heat exchange by Radiation between grey surfaces, - Radiation shields – effect on heat transfer (Numerical to calculate heat flow rate between two surfaces)	12

6. Heat Exchanger	1. List the various types of heat exchangers 2. Determine the LMTD and heat flow rate through various heat exchangers 3. State the functions of condensers, radiators, cooling tower, solar appliances 4. Interpret the use of various heat exchangers in industry or domestic appliances.	6.1 Introduction – Definition, classification, application 6.2 Construction and working of parallel flow, counter flow, shell and tube type heat exchanger 6.3 Concept of Logarithmic Mean Temperature Difference (LMTD) for parallel flow and counter flow. (Numerical to calculate LMTD, heat flow rate) 6.4 Effectiveness of heat exchanger 6.5 Condensers – types and its functions 6.6 Radiators – types and its functions 6.7 Cooling Towers – types and its functions 6.8 Domestic Appliances – working principles and uses of Solar Cooker, Solar water heater and Solar drier.	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs
1	Identify the different apparatus used in various modes of heat transfer.	Introduction	4
2	Determine the thermal conductivity of a metal rod		2
3	Determine the thermal conductivity of insulating powder.	Steady State conduction	2
4	Determine the thermal conductivity of composite walls.		2
5	Determine the heat transfer coefficient, heat flow rate, fin efficiency and effectiveness using Pin fin apparatus for free convection	Heat transfer through Fins and convection	4
6	Determine the heat transfer coefficient, heat flow rate, fin efficiency and effectiveness using Pin fin apparatus for force convection		4
7	Determine the Stefan Boltzmann constant.	Radiation	2
8	Determine the heat transfer rate of solar radiation apparatus.		2
9	Determine the LMTD and heat transfer of shell and tube heat exchanger	Heat Exchanger	2
10	Determine the LMTD and heat transfer of parallel flow heat exchanger		2
11	Determine the LMTD and heat transfer of counter flow heat exchanger		2
Skill Assessment			4
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to Heat transfer	04(02)	06(04)	00(00)	10(06)
02	Steady State conduction	02(02)	04(00)	06(06)	12(08)
03	Heat transfer through Fins	00(00)	08(00)	04(06)	12(06)
04	Convection	02(00)	04(08)	06(00)	12(08)
05	Radiation	02(04)	04(04)	06(00)	12(08)
06	Heat Exchanger	00(00)	08(00)	04(04)	12(04)
	Total	10(08)	34(16)	26 (16)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	5	R	2	4	R	2	1	R	2	5/7
	2	R	2																
02	3	U	4	6	A	4	6	U	4	4	U	4	5	U	4				3/5
03	2	U	4	3	A	4	3	U	4	6	A	4	4	U	4				3/5
04	6	U	4	5	U	4	4	U	4	1	U	4	5	R	4				3/5
05	2	A	6	1	U	6	2	A	6										2/3
06	4	A	6	5	A	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing diagrams of experiment set up, equipments, writing procedure, etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	–	–
2	–	3	–	–	–	–	–	–	–	3	3	–
3	–	3	–	–	–	3	–	–	–	3	3	–
4	–	3	2	–	–	3	–	2	2	3	3	–
5	–	3	2	–	–	3	–	2	2	3	3	–
6	–	3	2	–	–	3	–	2	2	3	3	–

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE AND TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Heat and mass transfer	S. P. Sukhatme, Melisende UK Ltd, 4 th edition, 2005	9788173715440
2.	Heat and mass transfer	Arora and Domkundwar, Dhanpat Rai Pub. Pvt. Ltd., 2004 edition	9788177000290
3.	Heat and mass transfer	Prof. D.S. Kumar, S.K. Kataria and Sons, 2013 edition	9789350142691
4.	Heat and mass transfer	Prof. R. K. Rajput., S Chand , 2015 edition	9789385401930

❖ **E-REFERENCES:**

- 1) nptel.ac.in/courses/112101097/, assessed on 23rd August, 2016
- 2) <https://www.youtube.com/watch?v=qa-PQOjS3zA>, assessed on 4th August, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Apparatus to determine thermal conductivity of metal rod, insulating powder and composite wall
- Stefan Boltzmann apparatus
- Pin fin apparatus
- Solar flat plate collector
- Shell and tube type, parallel flow, counter flow heat exchanger

❖ **LIST OF EXPERTS AND TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Prof. O. V. Sarode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
2	Prof. S. A. Dhankute	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3	Prof. D. J. Ghode	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
5.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
6.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: ME504E ^s
COURSE TITLE	: COMPUTER INTEGRATED MANUFACTURING
PREREQUISITE	: NIL
TEACHING SCHEME:	TH: 04; TU: 00; PR: 02
TOTAL CREDITS	: 05(1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT=1 CLOCK HR.)
TH. TEE	: 03 Hrs.
PR. TEE	: 02 Hrs. (External)
PT	: 01 Hrs.

❖ RATIONALE:

This course is classified under Elective courses. Competition has an important role to survive for manufacturing industries in global economic market. It is more important capability of producing through diverse customer's demand with very short time to the market for manufacturing companies. Computer Integrated Manufacturing (CIM) is the integration of the total manufacturing enterprise through the use of integrated systems and data communications coupled with new managerial philosophies that improve organization and personnel efficiency.

To satisfy industrial need, diploma engineer should be able to cope with CAD/CAM & CIM. Detail knowledge of above mentioned aspects with deep insight to the practical applications develop a professional confidence in them to become successful engineers in manufacturing industries.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Interpret joints and configuration of Robot for particular applications.
2. Recognize various elements of CIM wheel.
3. Calculate system throughput for AS/RS system.
4. Apply OPITZ coding system for particular part.
5. Develop Flexible Manufacturing System for particular applications.
6. Prepare Industrial visit Report.

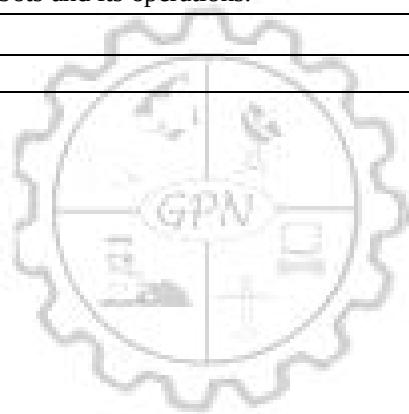
❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction To CIM	1. Define CIM. 2. Draw CIM wheel. 3. Describe evolution of CIM. 4. List benefits of CIM.	1.1 Definition of CIM 1.2 CIM Wheel 1.3 Concept of CIM 1.4 Evolution of CIM 1.5 Benefits of CIM (Tangible and Intangible)	06
2. Robot Technology	1. Define Robot. 2. State qualities of Robot. 3. Identify type of Robot 4. joints for specific applications. 5. Draw various robot Configurations. 6. Compare Robot joint system. 7. Select robot control system for particular applications. 8. State types of Grippers. 9. List benefits of installation of Robot. 10. State social issues in installation of robot.	2.1 Definition of Robot, qualities of Robot. 2.2 Robot And Related Attributes Types of Joints, Common Robot Configurations. Polar coordinate, Cylindrical coordinate, Jointed arm, Cartesian coordinate, SCARA 2.3 Basic Robot motions, Six degrees of freedom in robot motion, Motion systems, Wrist configuration, joint notation system, work volume. 2.5 Robot Joint drive system: Electric, Hydraulic, Pneumatic. 2.6 Robot control systems Limited sequence control, Playback with Point to Point Control, Playback with Continuous Path control. 2.7 End Effectors, Types of Grippers, Tools 2.8 Benefits of installing Industrial robot, social issue.	12
3. Robot Application And Material Handling	1. Describe Robot applications. 2. Define AGV. 3. State types of AGV. 4. Draw types of AGV 5. Select vehicle guidance technology for particular applications. 6. Describe management of AGV. 7. Calculate system throughput for AS/RS.	3.1 Robot Applications: Material handling, machine loading & unloading, processing operation & assembly application 3.2 Automated guided vehicle: Definition, Types of vehicles, Vehicle guidance technology, Vehicle Management: traffic control and vehicle dispatching. 3.3 Automated storage systems: Automated storage/retrieval Systems: types, applications. Carousel storage systems (Numerical analysis on system throughput for AS/RS system only.)	12

4. Group Technology And Computer Aided Process Planning	1. Define Group Technology. 2. Define part families. 3. Compare process type layout and GT layout. 4. Interpret the code for given part using OPITZ system. 5. State applications of GT. 6. Group the machines in machine cell using ROC 7. Describe Retrieval type CAPP. 8. Describe Generative type CAPP. 9. Draw flow diagram for Retrieval type CAPP.	4.1 Group Technology: Definition, Part families, Process type layout and GT layout, Part classification and coding, Coding system structure, Opitz parts classification and coding system, Grouping parts and machines by Rank Order Clustering (Numerical on ROC). Applications of GT. 4.2 CAPP The planning function, Retrieval type computer aided process planning system, Generative type computer aided process planning system, Benefits of CAPP.	12
5. FMS	1. Define FMS. 2. State flexibility tests for FMS. 3. Describe types of FMS. 4. Describe FMS components. 5. Draw the FMS system for particular type. 6. List applications of FMS. 7. List benefits of FMS. 8. State planning issues of FMS. 9. State implementation issues of FMS. 11. Select type of FMS for particular application.	5.1 Definition of flexible manufacturing system, Tests of Flexibility, Types of FMS on the basis of number of machines, and Flexibility. 5.2 FMS Components Workstations: Load unload stations, Machining stations, other processing stations, assembly Material handling and storage System: Functions, Equipments, Layout configurations Computer Control system: Various functions of computer control system Human Resources. 5.3 Application and benefits of FMS, FMS Planning and Implementation Issues .	12
6. Computer Aided Inspection	1. Define inspection technology. 2. Define CMM. 3. Select proper type of structure of CMM for particular application. 4. Describe the procedure to measure dimensions and geometry of given part using CMM. 5. Describe machine vision 6. Describe laser system. 7. Identify the types of CMM structure configuration	6.1 Introduction to inspection technology 6.2 Coordinate Measuring machine: Definition, CMM construction i) Probe and its types ii) Mechanical Structure and its types. CMM applications and benefits. 6.3 Machine Vision: Definition, Operation of Machine Vision, Machine Vision application 6.4 Other optical inspection method: Laser Systems	10
		Total Hrs.	64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Draw wheel CIM model which represent the concept of CIM.	Introduction To CIM	04
2	Identify type of joints, configuration, of given model of Robot.	Robot Technology	06
3	Calculate system throughput for AS/RS System. (solve one numerical)	Robot Application And Material Handling	04
4	Interpret the code for the given part using OPITZ system.	Group Technology , Computer Aided Process Planning	04
5	Measure dimensions and geometry of given part using CMM machine.	Computer Aided Inspection	06
6	Prepare Visit Report on industrial/institute visit to see the use of robots and its operations.	ALL units.	06
Skill Assessment			02
Total Hrs.			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction To CIM	04(00)	06(04)	00(00)	10(04)
02	Robot Technology	00(00)	04(04)	08(04)	12(08)
03	Robot Application And Material Handling	02(00)	06(04)	04(06)	12(10)
04	FMS	04(00)	02(00)	06(06)	12(06)
05	Computer Advance Process Planning	00(04)	08(04)	04(00)	12(08)
06	Computer Aided Inspection	00(00)	08(04)	04(00)	12(04)
	Total	10(04)	34(20)	26(16)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	3	R	2	4	R	2	4	R	2	4	U	2	6	U	2	1	U	2	5/7
	1	U	2																
02	1	R	4	2	U	4	5	U	4	1	U	4	2	A	4				3/5
03	2	A	4	2	A	4	5	U	4	3	U	4	5	U	4				3/5
04	3	A	4	5	A	4	6	A	4	5	R	4	6	U	4				3/5
05	1	U	6	3	U	6	3	A	6										2/3
06	4	A	6	6	U	6	4	A	6										2/3

T= Unit/Topic Number L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing diagrams of Robot joints, configurations, AS/RS system, CMM machine, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawings (if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	3	2	–	–	–	–	–	3	3
2	–	3	–	3	–	–	–	3	–	–	3	3
3	–	3	–	3	–	–	–	–	–	–	3	3
4	–	3	2	3	–	–	–	3	–	2	3	3
5	–	3	2	3	2	–	–	3	–	2	3	3
6	–	3	2	3	–	–	–	3	1	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Industrial Robotics Technology ,Programming and Applications.	Mikell P Groover, Mitchell Weiss, Roger Nagel, Nicholas Odrey, Mcgraw-Hill International Edition, 1987	0-07-100442-4
2.	Principles Of Computer - Integrated Manufacturing	Vajpayee S. Kant, PHI Learning Pvt. Ltd., Edition 2005	10: 812031476X
3.	CAD/CAM, Computer –Aided Design and Manufacturing	Mikell P Groover, Emory W Zimmers, Jr. Prentice Hall Publication, Edition 2009	978-81-7758-416-5
4.	Automation, Production Systems, and Computer-integrated Manufacturing	Mikell P Groover, PHI learning private limited, Edition 2008	9780132393218

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/112101099/1>, assessed on 29th July, 2016
- <http://nptel.ac.in/courses/112101099/3> assessed on 29th July, 2016
- <https://www.youtube.com/watch?v=tiarT1YS-IM> assessed on 3rd October, 2016
- <https://www.youtube.com/watch?v=fmrar8DJFc> assessed on 3rd October, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Charts for OPITZ parts classification and coding system.
- Co-ordinate measuring machine:- Measuring volume at least 500 mm x 400 mm x 440 mm, accuracy-0.1 μ m, PC control, portable, Probe/Sensors- Touch type.
- F7000N Series Desktop Industrial Robot,
Worktable Load/Tool = 10 kg./5 kg.
Max. Speed X & Y /Z = 800/320(mm/axis)
Repeatability = +/- 0.02 mm/axis.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Prof. R A Gadekar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
2.	Prof. P. P. Patil	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
3.	Prof. D. J. Ghode	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
4.	Prof. G. H. Dahole	Lecturer in Mechanical Engineering	Govt. Polytechnic, Nagpur
5.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6.	Prof.. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
7.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING

LEVEL NAME : ELECTIVES COURSES

COURSE CODE : ME505E^s

COURSE TITLE : INDUSTRIAL FLUID POWER

PREREQUISITE : NIL

TEACHING SCHEME: TH: 04; TU: 00; PR: 02(CLOCK HRs.)

TOTAL CREDITS : 05 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1CLOCK HR.)

TH. TEE EXAM : 03 HRs

PR. TEE EXAM : 02 HRs (External)

PT. EXAM : 01HR

❖ **RATIONALE:**

Industrial Fluid Power deals with the power transmitting system, employing pressurized oil or air to transmit energy from an energy generating source to an energy use area. This is sub-categorized as oil hydraulics and pneumatics. The concepts of hydraulics and pneumatics are important and indispensable tools being used in the innovations, circuit design and improvement of engineering processes and devices. Different types of power sources, valves and actuators are essential elements in all the manufacturing industries, specially where automation and control is required. This course is designed to develop underpinning knowledge of hydraulic and pneumatic systems which are widely used for control and other purposes in Industry as machine tools, material handling, etc

This course will give the students, the basic skills and knowledge of oil hydraulics and pneumatics which will be directly needed in the industrial environment.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Identify various components of hydraulic and pneumatic systems.
2. Apply principle of various components used in hydraulic and pneumatic systems.
3. Interpret hydraulic and pneumatic circuits for various applications.
4. Construct hydraulic and pneumatic fluid based systems.
5. Develop hydraulic and pneumatic circuits for various applications.
6. Construct various hydraulic and pneumatic special purpose industrial circuits.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Basics of Oil Hydraulic Systems	1. Draw general layout of hydraulic system 2. Identify various components in Structure of oil hydraulic system/circuits 3. State practical application of oil hydraulic system. 4. List Merits and limitations of oil hydraulic systems. 5. State Pascal's Law and properties of fluid. 6. Describe the construction and working principle of various Pumps. 7. Distinguish between all types of pumps.	1.1 General layout, Practical Applications, Merits and limitations of oil hydraulic systems 1.2 Pascal's Law and Force Multiplication 1.3 Properties- Compressibility, Viscosity, Demulsibility, Lubricity, Resistance to Oxidation (aging), Air separating ability, Fire Resistance and Flash point. 1.4 Requirements of good hydraulic fluid. 1.5 Hydraulic Pumps- Construction, working principle, applications and symbols of gear pump, Gerotor pump, Vane pump, screw pump, Piston Pump	08
2. Components of oil Hydraulic system	1. Identify hydraulic components from symbols. 2. Memorise Fluid Power Symbols according to ISO 1219-1976, (1991). 3. Describe the construction and working principle of all types of valves. 4. Distinguish between all types of Valves. 5. Describe Servo valves. 6. Describe the construction and working principle of Actuators. 7. Select valves, actuators and accessories for the given application. 8. List various materials for hydraulic pipes. 9. Name different types of pipe and tube fittings. 10. State function and causes of failure of seal. 11. State function and Location of Filter. 12. Describe the construction and working of Accumulators and pressure Intensifier. 13. State need of Accumulators and	2.1 Hydraulic control valves :-Necessity of fluid control system 2.2 Hydraulic Valves:- Construction, principle of working and symbols of Pressure control valves - pressure relief valve - direct, pilot operated, pressure reducing, pressure unloading, Sequence valves and counter balancing. 2.3 Direction control valves - Poppet valve, spool valve, 2/2, 3/2, 4/2, 4/3, methods of actuation. Types of different center positions. Check valves, pilot operated check valves. 2.4 Flow control valves - pressure compensated, non pressure compensated flow control valve, 2.5 Servo Valves: - Two-stage servo valve, Jet pipe servo valve, Flapper jet servo valve. 2.6 Actuators:- Classification of actuators Construction, working principle and symbols of Rotary Actuators –Limited Rotary: - Vane type and Dual piston type Limited rotary. 2.7 Hydraulic motors: - gear type, Vane type and Piston type Motor. Linear Actuators - Cylinders - single acting, double acting, and their subtypes. Different mounting methods. 2.8 Accessories- Construction, working principle and symbols of Pipes, Hoses, Fittings, Oil filters, Seals and gaskets,	17

	pressure Intensifier in hydraulic circuits.	2.9 Accumulators and pressure Intensifier or Booster.	
3.Oil Hydraulic Circuits	14. Describe construction of oil hydraulic circuits by using various components of hydraulic system. 15. Choose Fluid Power Symbols to draw hydraulic circuits. 16. Apply changes in hydraulic circuits. 17. Develop oil hydraulic circuit for different applications. 18. Describe working of Speed control, sequence control, Synchronizing, Hydraulic Motor Control circuits. 19. Describe Industrial hydraulic circuits.	3.1 Linear circuit 3.2 Re-generative circuit. 3.3 Speed control; - Meter-in, Meter-out, Bleed-off Circuit. 3.4 Sequence control circuits: - Travel dependent and Pressure dependent. 3.5 Synchronizing circuits: - Synchronizing circuit with mechanical coupling, Synchronizing with flowing valves. 3.6 Hydraulic Motor Control circuits: - Speed control of a bi-directional motor, Free-running off and blocked off hydraulic motor circuits. 3.7 Industrial hydraulic circuits:- Hydraulic circuits for Shaping machine, grinding machine and Milling machine	11
4. Introduction to Pneumatic Systems	1. Identify various components in simple pneumatic circuits 2. List the types of various components in simple pneumatic circuits. 3. State practical application and Merits – demerits of pneumatic system. 4. Describe construction and working of Air compressor. 5. Classify air compressor.	4.1 Applications of pneumatic systems General layout, merits and demerits of pneumatic systems, Comparison of Hydraulic and pneumatic, system. 4.2 Air compressors: - two stage reciprocating, Vane type rotary, Liquid ring type and Screw type air compressor. 4.3 Selection of air compressors for pneumatic circuits	06
5 Components of Pneumatic Systems	1. Identify hydraulic components from symbols. 2. Draw Fluid Power Symbols (pneumatic) as per Is 7513- 1974 and ISO. 3. State Pressure Regulating valve. 4. Describe construction and working principles of different Valves and actuators. 5. Identify actuation mechanism in pneumatic circuits. 6. Recommend Actuators for particular application in pneumatic system. 7. State function of FRL,	5.1 Valves:-Construction, principle of working and symbols of - • Pressure regulating valves: - spool type and Seat type valve. • Direction control valves:-2/2, 3/2, 4/2, 5/2 and 5/3 direction control valve. • Valve Actuation Mechanisms with symbol: - Mechanical actuation, Electrical actuation, Pneumatic actuation and Electro-pneumatic actuation. • Impulse valve (5/2 pilot operated) • Flow control valves: - Fixed and variable type flow control valves, Check valve (directly and pilot operated), Shuttle valve and Quick exhaust valve. • Time delay valve. 5.2 Actuators - Construction, working and	12

	dryers and mufflers in pneumatic system. 8. Describe construction and working of pipes, hoses and fittings.	symbols of • Rotary Actuators - Pneumatic motors • Linear Actuators – Cylinders - single acting, double acting. 5.3 Air preparation elements: - FRL unit, Dryers and mufflers. 5.4 Accessories- Construction, working and symbols of Pipes, Hoses, fittings.	
6. Pneumatic Circuits	1. Construct pneumatic circuits by using various pneumatic components. 2. Choose pneumatic symbols to draw pneumatic circuits. 3. Describe working of Speed control, sequencing and Time delay circuits.	6.1 Circuit for actuation of single and double acting cylinder 6.2 Impulse operating circuits. 6.3 Speed control circuit:-Speed control circuits for double acting cylinder and bidirectional air motor 6.4 Sequencing circuits - Position based sequencing circuit. 6.5 Time delay circuit	10
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Identify components of various types of oil hydraulic pump.	Basics of Oil Hydraulic Systems	04
2	Identify various types of valves in Oil Hydraulic Systems • Pressure control Valve • Flow control valve • Direction control valve	Components of oil Hydraulic system	06
3	Construct meter in and meter out circuit on hydraulic trainer.	Oil Hydraulic Circuits	04
4	Locate main components of pneumatic system.	Introduction to Pneumatic Systems	04
5	Interpret the given Pneumatic system. • FRL • Flow control valve • Time delay valve	Components of Pneumatic Systems	06
6	Construct pneumatic circuit to perform working of following operation. • Linear motion (single and double acting cylinder.) • Control of speed of pneumatic motor. • Sequence operation of liner actuators. • Time delay operation.	Pneumatic Circuits	06
Skill Assessment			02
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Basics of Oil Hydraulic Systems	02(00)	06(04)	00(00)	08(04)
02	Components of Hydraulic system	06(02)	08(04)	04(04)	18 (10)
03	Oil Hydraulic Circuits	00(02)	06(00)	06(04)	12(06)
04	Introduction to Pneumatic Systems	02(04)	04(00)	00(00)	06(04)
05	Components of Pneumatic Systems	06(00)	08(06)	00(04)	14(10)
06	Pneumatic Circuits	02(00)	04(06)	06(00)	12(06)
	Total	18(08)	36(20)	16 (12)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	2	R	2	4	R	2	5	R	2	6	R	2	2	R	2	5/7
	3	R	2																
02	2	R	4	2	U	4	2	U	4	1	U	4	2	U	4				3/5
03	2	A	4	4	U	4	5	R	4	2	A	4	3	A	4				3/5
04	4	U	4	4	U	4	6	U	4	4	R	4	5	A	4				3/5
05	3	U	6	3	A	6	5	U	6										2/3
06	1	U	6	6	A	6	6	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing fig, Drawing circuit diagram, selection of equipment's/ apparatus/ trainer (hydraulic or pneumatic). writing procedure etc.	15
2	Performance	20
3	Viva voce	15
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	3	-	-	-	-	-	-	-	3	3	-
2	-	3	-	-	-	-	-	3	-	-	3	-
3	-	3	-	-	-	-	-	3	-	3	3	-
4	-	3	2	2	-	-	-	3	2	3	3	-
5	-	3	2	2	-	-	-	3	2	3	3	-
6	-	3	2	2	-	-	-	3	2	3	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE and TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Oil Hydraulic system- Principles and maintenance	Majumdar S.R, Tata McGraw Hill education Pvt. Lid, New Delhi, illustrated, reprint Edition, 2002.	10: 0071406697 13: 9780071406697
2.	Pneumatic System- Principles and Maintenance	Majumdar S.R, Tata McGraw Hill education Pvt. Lid, New Delhi. 23 rd reprint edition , 2010	10: 0-07-460231-4 13: 978-0-07-460231-7
3.	Treatise on Hydraulics and Pneumatics Fluid Power.	Sameer Vazir Shaikh, Iliyas Rasul Khan, R. K. Publications,	-
4.	Industrial hydraulics	John J Pippenger, Tyler cregory Hicks, Gregg Division , Mc- Graw Hill, 3 rd Edition, 1979	0070501408 9780070501409
5.	Pneumatics and Hydraulics	Andrew Parr, Butterworth – Heinemann, 2 nd Edition, reprint , 1999	0080080508405 97800808405
6	Hydraulic and Pneumatics	Andrew Parr, Jaico publishing house, 1999.	
7	Audel Pumps and Hydraulics	Rex Miller, Mark Richard Miller, Harry L Steward , Audel, 6 th Edition, October, 2004.	13: 978-074571169 10: 0764571168
8	Hydraulic and Pneumatic A Technician's and Engineer's Guide	Andrew Parr, Butterworth Heinemann 3 rd Edition, March, 2011.	13-978-7506-4419-9 10:-7506-4419-2

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/112105047/> , assessed on 04th October 2016
- <http://nptel.ac.in/courses/112105046/> , assessed on 04th October, 2016
- <https://www.youtube.com/watch?v=8xd7cWvMrvEandindex=43andlist=PLbMVogVj5nJTKwm1WjlutrAEZrLE995Ja> , assessed on 04th October 2016
- <https://www.youtube.com/watch?v=NUEr3nqK5tgandlist=PL6pT08wMYnwyZMe4JKYaapxIoB7X7Xf> , assessed on 04th October, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Hydraulic Trainer
2. Pneumatic Trainer

❖ **LIST OF EXPERTS and TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. P. P. Patil	Lecturer, Department of Mechanical Engineering.	Government Polytechnic, Nagpur.
2.	Mr. A. R. Sheikh.	Lecturer , Department of Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
4.	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
5.	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN MECHANICAL ENGINEERING
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: ME 506E ^s
COURSE TITLE	: MATERIAL HANDLING
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 Hrs
PR. TEE	: 02 Hrs (External)
PT	: 01 Hr

❖ RATIONALE:

Material handling equipment is an integral part of modern industrial enterprise. The flow of material in industry depends on a rational choice of the material handling equipment, correct determination of its main parameters and efficient operation. Carrying parts & products in a shop from one work station to another, transferring them from shop to shop or taking care of stockpiling and reclaiming operations, material handling equipment/systems enable the process to go on without interruptions & at a predetermined pace.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply the knowledge of material handling and relevant concepts.
2. Identify types of loads, nature of movements, loading and unloading systems.
3. Select different types of conveying ,hoisting machinery and surface transport equipment
4. Prepare maintenance schedule of material handling equipments.
5. Prepare a visit report of material handling plant of industry.
6. Select proper material handling system for specific application.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Introduction to Material Handling Systems	1. Define material handling system. 2. Classify different material handling equipments. 3. Describe types of loads, nature of movements, loading and unloading systems. 4. State principles of material handling system. 5. Justify selection of different material handling systems.	1.1 Definition and scope of Material handling system 1.2 Main types of material handling equipments & their applications 1.3 Types of load to be handled, concept of unit load and bulk load 1.4 Types/ nature of movements, loading & unloading systems. 1.5 Principles and objective of material handling systems 1.6 Limitations of material handling system 1.7 Concept of Robotic handling systems.	10
2 Hoisting Machinery & equipments	1. Describe various types of hoist. 2. State types of cranes. 3. Identify various types of elevating equipments. 4. Practice maintenance measures for different types of hoists, cranes and elevating equipments.	2.1 Construction, working & maintenance of different types of hoists such as lever operated hoist, portable hand chain hoist, differential hoists, worm geared and spur geared hoists, electric & pneumatic hoists, winch & tur for 2.2 Construction, working & maintenance of different types of cranes such as rotary cranes, trackless cranes, mobile cranes, bridge cranes, cable cranes, floating cranes & EOT 2.3 Construction, working & maintenance of elevating equipments such as forklift, stackers, industrial lifts, freight elevators, passenger lifts, and mast type elevators, vertical skip hoist elevators.	10
3 Conveying Machinery	1. Describe traction & traction less type of conveyors. 2. Compare traction & traction less conveyors. 3. Practice different maintenance measures for traction & traction less conveyors.	3.1 Construction, working & maintenance of traction type conveyors such as belt conveyors, chain conveyors, bucket elevators, escalators, and slate conveyors, roller conveyors 3.2 Construction, working & maintenance of traction less type conveyors such as gravity type conveyors, vibrating & oscillating conveyors, screw conveyors, pneumatic & hydraulic conveyors	12
4 Surface Transportation equipment	1. State various types of trackless surface transportation equipment. 2. Describe features of Automatic Guided Vehicle 3. Select different cross handling equipment.	4.1 Construction, function, working of trackless equipment such as hand operated trucks, powered trucks, tractors, AGV- Automatic Guided vehicle, features, types and safety considerations, industrial Trailers 4.2 Construction, function, working of cross handling equipment such as winches, reach truck, capstans, Turntables, Transfer tables, monorail conveyors	10

5 Components of material handling systems	1. State various flexible hoisting appliances. 2. Describe fastening methods of wire & chains, eye bolts, lifting tackles. 3 Define load handling attachments. 4 State various types of hooks 5 Describe grabbing attachment for loose materials. 6 Justify selection of different crane attachments for handling liquids/molten metal	5.1 Flexible hoisting appliances such as welded load chains, roller chains, hemp ropes, steel wire ropes, fastening methods of wire & chains, eyebolts, lifting tackles 5.2 Load handling attachments- Various types of hooks-forged, triangular eye hooks, appliances for suspending hooks, b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter d) Grabbing attachment for loose materials e) Crane attachment for handling liquids / molten metals	12
6 Selection of Material Handling Equipment	1 Describe factors affecting choice of material handling equipments. 2 Calculate different material handling costs.	6.1 Factors affecting choice of material handling equipments 6.2 Economics of material handling system- material handling cost and economical aspects, safety cost and consideration. 6.3 Benefits of good material handling system.	10
Total Hrs			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Operate the working model of any one type of hoist, crane and lifting device.	Unit :2	6
2	Use working model of any one type of traction less conveyor.	Unit:3	6
3	Follow the maintenance practices of different material handling equipments.	unit:2,3,4	6
4	Prepare preventive maintenance schedule of any one major material handling device using operation manual or internet.	Unit:2,3,4	6
5	Prepare a visit report for coal handling plant of thermal power station or cement industry to, 1. Observe construction and working of various types of material handling devices. 2. Observe various load handling attachments, electric lifting magnets etc. 3. Follow the maintenance practices of different material handling equipments.	Unit:1,2,3,4	8
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to Material Handling Systems.	04(02)	08(04)	00(00)	12(06)
02	Hoisting Machinery and Equipments.	04(00)	08(06)	00(00)	12(06)
03	Conveying Machinery.	04(00)	08(04)	00(06)	12(10)
04	Surface Transportation Equipments.	02(00)	04(04)	06(00)	12(06)
05	Components of Material Handling Systems.	06(04)	00(02)	06(00)	12(06)
06	Selection of Material Handling Equipments.	04(04)	06(04)	00(00)	10(08)
	Total	24(10)	34(24)	12 (06)	70 (40)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	2	1	R	2	2	R	2	2	R	2	4	R	2	1	R	2	5/7
	5	U	2																
02	3	R	4	1	U	4	1	U	4	1	U	4	3	U	4				3/5
03	2	U	4	2	U	4	3	U	4	5	R	4	4	U	4				3/5
04	6	R	4	3	U	4	4	U	4	6	R	4	6	U	4				3/5
05	3	U	6	6	U	6	2	U	6										2/3
06	4	A	6	5	A	6	3	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	20	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Technical knowledge and willingness to learn.	10
2	Skill.	20
3	Performance and attitude.	10
4	Viva voce.	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	–	–	–	–	–	3	3	–
2	–	3	–	3	–	–	–	–	–	3	3	–
3	–	3	–	–	2	–	–	–	–	3	3	–
4	–	3	2	3	–	–	–	2	2	3	3	2
5	–	3	2	3	–	–	–	2	2	3	3	2
6	–	3	2	3	–	–	–	2	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Plant layout and material handling.	R. B. Chaudhary and G. R. N. Tagore, Khanna Publication, 2 nd Reprint 2013.	81-7409-105-X
2.	Material handling (principle and practice)	Allegri T. H. CBS Publisher, 2 nd Edition, 2004	9788123908403
3.	Plant layout and material handling.	Apple J.M, John Wiley Publishers, 3rd Edition, 1978.	978-0471071716
4.	Plant Layout and Material handling.	S.C.Sharma, Khanna Publication Delhi, 3 rd Edition, 2013	978-81-7409-319-6

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=BaEHVpKc-1Q> , assessed on 29th March, 2016
- https://en.wikipedia.org/wiki/Material_handling, assessed on 29th March, 2016
- www.mhi.org/fundamentals/material-handling, assessed on 20th March, 2016
- www.newagepublishers.com/samplechapter/001455

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- Working models of different types of hoist, cranes.
- Working models of different types of elevating equipments and conveyors.
- Working models of different types of track less equipment like trucks, tractors and trailers.
- Different types of flexible hoisting appliances and load handling attachments.
- Working models of various power transmission drives

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. M. M.Dangre	Lecturer in mechanical Lecturer engg.	Government Polytechnic Nagpur
2.	Mr. A. V. Abhyankar	Lecturer in mechanical engg.	Government Polytechnic Nagpur
3.	Er. A. M. Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
4.	Shri. G. F. Potbhare	Principal	NIT, Polytechnic, Nagpur
5.	Dr. S. S. Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

 (Member Secretary PBOS)

 (Chairman PBOS)

FREE ELECTIVES

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/CM/IT/MT/PK/AE/TX/TR
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FS501E
COURSE TITLE	: FINISHING SCHOOL
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK Hrs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: NIL
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: NIL

❖ RATIONALE:

Polytechnic Diploma pass outs who are not readily employable in the desired target jobs, need further grooming. Diploma engineers are not fit for relevant jobs in related work areas in corporate due to lack of required skills like communication, team work, arithmetic, public speaking, attitude building, ethics, business etiquettes etc. This 'disconnects' between the desired jobs and the qualifications obtained needs to be addressed by institutes. This course helps in bridging the gap between Formal education and Industry requirements. Industries and Institutes have a role to play. A pre-employment training programme in which curriculum is developed for students to prepare them for requirements of industries. It aims to provide soft skills to student to facilitate their employability and play a part in the supply side issues (of talent) of the industry. Students then can adapt themselves to the industrial scenario.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

- 1 Perform SWOT analysis
- 2 Demonstrate soft skills.
- 3 Enhance employability skills.
- 4 Adapt ethics and values.
- 5 Practice interpersonal skills.
- 6 Refine communication skills.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes(Cognitive Domain)	Topics and subtopics	Hrs
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	- Identify Strengths and Weaknesses of Self - Observe Opportunities and Threats in Self - Exhibit different interpersonal skills in given situations.	A. Soft Skills Understanding self & others a. SWOT Analysis b. Interpersonal Skills	4
2	- Practise face to face communication in formal/informal groups. - Observe Body Language of others and note the changes in different persons. - Construct and demonstrate short public speech of five minutes on a topic of interest. - Identify signs and signals as a means of communication and list them.	A. Soft Skills Communication Skills a. Verbal & Non Verbal Communication b. Body Language c. Sixth sense Intuition d. Public Speaking	8
3	- Identify factors in self esteem. - Produce a list of behavioural elements of concentration. - Practise tongue twister to enhance power of concentration.	A. Soft Skills Self Confidence a. Strength of Conviction b. Power of Concentration c. Self Esteem	4
4	- Practise three different dress combinations for professional presentation. - Demonstrate three social manners and etiquettes in a group task	A. Soft Skills Presenting Self a. Fine Grooming b. Dress Sense c. Manners & Etiquettes	4
5	- Set career goals for next five years and list activities to achieve these goals. - Prepare a chart of daily routine activities with Important, Very important, Urgent and Very urgent	A. Soft Skills Effective Self Management a. Goal Setting b. Time Management c. Emotional Quotient d. Motivating self and	6

	classification. - Identify assertive behavioural aspects of persons in your surrounding - Identify factors/elements related to emotional balance in given situations.	Others e. Positive Thinking & Assertiveness	
6	- Practise yoga /meditation. - Prepare a habit plan and list steps for action plan. - Construct diet chart for self.	A. Soft Skills Personality Development a. Physical & Mental Health b. Habit formation- Do's & Don'ts c. Diet Pyramid	6
7	Exhibit attitude as response to various situations (case studies).	B. Employability Skills Attitudes	2
8	Demonstrate technical skills of different subjects.	B. Employability Skills Technical Skills	6
9	Observe the weakness domain of the individuals in given situations.	B. Employability Skills Adaptability	4
10	- Compose creative essay. - Suggest creative solutions to various given situations.	B. Employability Skills Creativity and Innovation	4
11	Exhibit team spirit and leadership qualities while working in a team.	B. Employability Skills Interpersonal Skills a. Working in Team b. Leadership	4
12	Practise Role play in group to exhibit corporate culture.	B. Employability Skills Corporate culture	4
13	- Prepare Resume. - Practise Group Discussions. - Demonstrate interview techniques through mock interview.	B. Employability Skills Job Selection Process a. Resume Writing b. Group Discussions c. Personal Interview	8
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Not Applicable

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Not Applicable

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Report writing	20
2	Presentation Skills	20
3	Viva voce	10
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (Pos)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	2	-	-	-	3	-	3	-	-
2	-	-	3	-	3	-	3	3	3	3	-	-
3	-	-	-	2	3	-	3	3	3	3	-	-
4	-	-	-	-	3	2	3	3	3	3	-	-
5	-	-	3	-	3	2	3	3	3	3	-	-
6	-	-	3	-	3	2	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	How to win friends and Influence people	Dale Carnegie, Fingerprint Edition 2016	10: 8175993480 13: 978-8175993488
2.	The SWOT Analysis	Lawrence G. Fine, Createspace Edition 2009	10: 1449546757 13: 978-1449546755
3.	Body Language	Allan Pease, Manjul Publishing House Pvt. Ltd., Edition 2014	10: 8183224105 13: 978-8183224109
4.	The Spark is Within You	Jagdish Bali, Authorspress, Edition 2016	10: 9352072332 13: 978-9352072330
5.	How to Read a Person Like a Book	Rupa Publications India, Edition 2012	10: 8129119188 13: 978-8129119186

6.	Believe in Yourself	Dr. Joseph Murphy, Manjul Publishing House Pvt. Ltd., 1 st Edition 2014	10: 8183225098 13: 978183225090
7.	Think and Grow Rich	Napoleon Hill, Jaico Publishing House; First edition 2007	10: 817992792X 13: 9788179927922
8.	Communication Skills	Sanjay kumar, Oxford Edition 2011	10: 0198069324 13: 9780198069324
9.	The Power of your Sub conscious Mind	Dr. Joseph Murphy, Amazing Reads Edition 2015	10: 8192910962 13: 9788192910963
10.	The Power of Positive Thinking	Norman Vincent Peale,	10: 0091906385 13: 9780091906382
11.	The Ace of Soft Skills: Attitude, Communication and Etiquette for Success	Gopalaswamy Ramesh	10: 8131732851 13: 978-8131732854

❖ E-REFERENCES:

- https://en.wikipedia.org/wiki/Soft_skills accessed on 20th September, 2016
- <http://www.p21.org/about-us/p21-framework/262> accessed on 1st November 2016
- <http://innovationexcellence.com/blog/2012/08/04/whats-the-difference-between-creativity-and-innovation/> accessed on 10th October 2016
- <http://study.com/academy/lesson/self-understanding-and-self-concept.html> accessed on 20th October, 2016
- <http://www.skillsyouneed.com/ips/understanding-others.html> accessed on 20th October, 2016
- <http://articles.bplans.com/how-to-perform-swot-analysis/> accessed on 19th September, 2016
- <http://www.skillsyouneed.com/ips/body-language.html> accessed on 19th September, 2016
- <https://www.mindtools.com/CommSkll/PublicSpeaking.htm> accessed on 19th September 2016
- https://www.mindtools.com/pages/article/newHTE_90.htm accessed on 20th October 2016

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. D.S. Kulkarni	HOD, Textile Manufacture	Government Polytechnic, Nagpur.
2.	Dr. Surendra Gole	Corporate HR Trainer, Former Principal,	Nagpur Institute of Technology, Nagpur
3.	Mr. Ashish Khole	Divisional Manager	TAL - Areospace Business Unit – (Tata Group of company) Nagpur
4.	Dr. Rozina Rana	Director	ELAN Finishing School, Priyadarshini Group of Institutions
5.	Mr. Sarang Sawangikar	Asstt. Vice President(HR)	Vidarbha Power Ltd., Butibori
6.	Ms. M.M.Machale	Lecturer in English	Government Polytechnic, Nagpur
7.	Dr. S.W.Rajurkar	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
8.	Mr. G.V.Gotmare	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/EE/EC/CM/IT/ TX/MT/PK
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE501E
COURSE TITLE	: BASIC BUILDING DRAWING
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR)
TH.TEE	: NIL
PR.TEE	: 02 HRs (Internal)
PT	: NIL

❖ RATIONALE:

Various agencies involved in engineering works use drawings as effective medium of communication. Engineering professionals of fields, other than civil engineering like mechanical, electrical, chemical, polymer mining, metallurgy etc. are required to interpret the space in the given building to assess whether their installations can be housed in the building or to specify the space requirements of their machineries, assemblies and installations. Moreover as an individual everyone of any profession wants to visualize his/her home before it is build, therefore these professionals need to study basic of building drawings such as plan, elevation and sections etc. This curriculum is designed to develop the basic skills of drawing building plan, elevation and section.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify different types of lines and symbols used in working drawings.
2. Prepare line plans of buildings for different orientations and with different scales.
3. Prepare plan, elevation and section of an existing building by taking measurements.
4. Develop working drawing duly considering rules, regulations and byelaws of sanctioning authority.
5. Identify the units and their sizes required in a building for serving a given purpose.
6. Interpret plan, elevation and section of building.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Draw different types of lines, common notations/symbols used in civil engineering and also symbols used in their field to be shown in the plan (A1size sheet).	Basics of Civil Drawing	10
2	Prepare line plans of small residential building (1BHK) for different plot orientation and with different scale on graph paper (A1size).	Drawing line plans	10
3	Prepare line plans of Public building like (Primary school building and Primary Health Centre) specifying names and sizes of different units. Prepare a separate report giving units, their sizes and justification for sizes.		10
4	Prepare a Measured drawing of institutional workshop/any small building. Show placement of machines/electrical fixtures etc.	Measured drawing	12
5	Develop a working drawing of any one of the building drawn in Practical no.2 considering rules, regulations and bye laws of local /other sanctioning authority.	working drawing	12
6	Draw plan and sectional elevation of Bifurcated/ Dog legged staircase.		06
7	Interpret dimensions and sizes of various units in the given building drawing.	Interpretation	04
Total			64

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
	Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6
End Of Course		End Of The Course	Questionnaires					

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Draw to the suitable scale a detailed plan of two room building.	20
2	Dimensioning	10
3	Neatness	10
4	Viva -Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	-	-	-	-	-	3	-	3	-	-
2	-	-	3	3	-	-	-	3	3	3	-	-
3	-	-	3	3	-	-	-	3	3	3	-	-
4	-	-	3	3	2	2	2	3	3	3	-	-
5	-	-	-	-	-	-	-	3	-	3	-	-
6	-	-	-	-	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Building Drawing: With an Integrated Approach to Built Environment	M.G. Shah, C.M.Kale and V. Y.Patki Tata McGraw-Hill Publishing Company Ltd. 4 th edition, 2002	10:0074638769
2.	Building Planning and Drawing	Dr.Kumara Swamy and A. Kameshwara Rao , Charotar Publications , 8th edition, 2015	13:9789385039126
3.	Civil Engineering Drawing and House planning	B.P.Verma, Khanna Publications, 11 th Edition,1986	13:9788174091688
4.	Civil Engineering Drawing	Gurucharan Singh, Standard Publications, 2009	13:9788180140044
5.	Civil Engineering Drawing	R. S. Malik,G.S. Meo, Computech Publications ltd./ New Asian Publications, 5 th edition, 2015	13:9788173180026

❖ **E-REFERENCES:**

1. <http://bie.telangana.gov.in/Pdf/civilenggdrawing.pdf>, accessed on 3rd September, 2016
2. <http://www.iar.unicamp.br/lab/luz/ld/Arquitetural/livros/interior%20design%20student%20handbook.pdf>, accessed on 3rd September, 2016.
3. <https://law.resource.org/pub/in/bis/S03/is.962.1989.pdf> accessed on 3rd September, 2016
4. http://civilengineering-notes.weebly.com/uploads/1/1/7/5/11750056/building_bye_laws.pdf accessed on 3rd September, 2016
5. <http://civil.emu.edu.tr/courses/civ1103/Tutorial%205.pdf> accessed on 3rd September, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. R. N.Giradkar	Head of Civil Engineering Deptt.	Government Polytechnic, Nagpur.
2.	Dr. D. N. Kongre	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
3.	Mr. S. R. Kukadapwar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
4.	Mr. M.K.Panchwate	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
5	Dr. S. J. Nikam	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
6	Mr. M. R. Shelote	Consultant Engineer	M. R. Associates, Nagpur.
7	Dr. R. N. Khapre	Associate Professor	Ramdeobaba College of Engineering and Management, Nagpur
8.	Mr. A. J. Fulzele	Assistant Secretary (Technical)	MSBTE, Regional Office, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/EE/EC/CM/IT/MT/PK/AE/TR/TX
LEVEL NAME	: FREE ELECTIVES
COURSE CODE	: FE502E
COURSE TITLE	: RAC MAINTENANCE
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: NIL
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: NIL

❖ RATIONALE :

The knowledge of repair and maintenance of domestic refrigerator and air conditioner is helpful in daily life. One should acquire skills in carrying out basic repairs and maintenance of refrigeration and air conditioning.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify various components of refrigeration and air conditioner.
2. Handle various tools
3. Test and find faults in refrigerator and air conditioner
4. Diagnosis fault of refrigerator and air conditioner.
5. Practice maintenance procedure
6. Practice safety procedure.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical No.	Specific Learning Outcomes (Psychomotor Domain)	Topics	Hrs.
1.	Identify the components of domestic refrigerator and write report. Report includes- -Basic concept of refrigeration -Vapor Compression Refrigeration system -COP, Ton of refrigeration	Introduction to Refrigerator	10
2.	Identify the hand tools required for maintenance of domestic refrigerator. Use tools for various applications and write report. -Specification of tools	Hand Tools	04
3.	Dismantle compressor, identify various components in compressor and write report. Report includes – -Hermitically sealed compressor - various components of compressor	Compressor	08
4.	Test Electric circuit and electrical controls used in refrigerator and report writing. Report writing includes – -Electric circuit diagram -Various controls and its function	Electric circuit of refrigerator	04
5.	Identify various faults and write report Report includes – -Various faults - Remedies	Fault finding and maintenance of refrigerator	08
6.	Run water cooler test rig and Write report. Report writing includes- -Working of water cooler -various components of water cooler	Water cooler	04
7	Identify the components of air conditioning system and write report. Report includes- -Basic concept of air conditioning -Various air conditioning systems like summer AC, winter AC, comfort AC.	Air conditioning system	08
8	Identify of various faults and write report Report includes – -Various faults - Remedies	Fault finding of air conditioner	08
9	Test Electric circuit and electrical controls used in AC and report writing.	Electric circuit of air conditioner	04

	Report writing includes – -Electric circuit diagram -Various controls and its function		
10	Identify the components of car air conditioning system and write report. Report includes- -Basic concept of car air conditioning -function of various components of car AC	Car Air Conditioning system	04
Skill Assessment			02
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

NIL

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

NIL



❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing of Sketch, selection of equipment's, procedure etc.	20
2	Performance	10
3	Conclusion	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	-	-	-	-	3	3	-	-	-
2	-	-	3	3	-	-	-	3	-	3	-	-
3	-	-	3	3	-	-	-	3	3	3	-	-
4	-	-	3	3	1	-	-	3	3	3	-	-
5	-	-	3	3	-	-	-	3	3	3	-	-
6	-	-	3	3	1	-	-	3	3	3	-	-

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Refrigeration and air conditioning servicing	S. Kumar, New Heights Publication New Delhi	--
2.	Refrigeration and Air Conditioning	R.S. Khurmi, S.Chand and Co.	81-219-1687-9
3.	Refrigeration and Air Conditioning	C.P. Arrora, Tata Mc-Graw Hill,	0-07-451515-2
4.	Refrigeration and Air Conditioning	Manohar Prasad, New Age Publications.	13: 9788122414295
5.	Refrigeration and Air Conditioning	P.N. Ananthanarayanan; Tata McGraw Hill	0074620088

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Air conditioning trainer kit
2. Water cooler trainer kit
3. Ice plant trainer kit
4. Window Air conditioner
5. Split air conditioner
6. Domestic Refrigerator
7. Car air conditioning trainer kit

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Prof. O. V. Sarode	Head, Mechanical Engineering	Government Polytechnic, Nagpur
2	Dr. S. W. Rajurkar	Lecturer, Mechanical Engineering	Government Polytechnic, Nagpur.
3	Prof. D. J. Ghode	Lecturer, Mechanical Engineering	Government Polytechnic, Nagpur.
4	Prof. K. S. Thekedar	Lecturer, Mechanical Engineering	Government Polytechnic, Nagpur.
5	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6	Shri. G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur
7	Dr.S.S.Baraskar	Lecturer in Mechanical Engineering	Govt. Polytechnic, Arvi

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/AE/PK/MT/EC/IT/CM /TX
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE503E
COURSE TITLE	: ELECTRICAL MAINTENANCE
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT =2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

Electricity is a basic need of human beings. All are dealings with the different electrical gadgets as well as electrical installations in day to day life. Therefore, the knowledge of electrical maintenance is must for all the peoples. One should have ability to acquire skills in carrying out repairs of electrical gadgets with accuracy and maintain the electrical installations. This course imparts the practical skills of electrical maintenance.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use electrical maintenance tools and equipment's.
2. Use fire-fighting equipment on different types of fires.
3. Test, Repair and maintain the domestic appliances.
4. Locate and repair the faults in electrical installation.
5. Identify the faults.
6. Follow safety precautions.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Identify electrical measuring instruments, sources, ICDP/ICTP, switches, loads, wires and execute safety precautions in laboratory.	Electrical Safety	4
2	Use firefighting equipment on different fire.		4
3	Identify different electrical maintenance tools and electrical accessories.	Maintenance Tools	4
4	Test single phase and three phase supply using test lamp and identify phase and neutral using test lamp.		4
5	Perform continuity, open circuit, short circuit and earth fault test using series test board.		4
6	Test and find fault in an automatic/ semiautomatic/ steam electric iron/toaster/room heater/hot plate	Domestic Appliances	4
7	Test, find faults and repair ceiling fan.		4
8	Test, find faults and repair electric mixer.		4
9	Identify different wiring systems in the premises & prepare list of accessories required for each.	Electrical Installation	4
10	Test & measure insulation resistance of Electrical lab wiring installation by using megger.		4
11	Measure the earth resistance of earth electrode by using earth tester.		4
12	Connect single phase and three phase energy meter to load and note the reading.		4
13	Prepare a wiring of two lamp controlled by two one way switch by using conduit wiring.		6
14	Fix ICDP/M CB/ DB/ELCB on wiring board & connect it to supply.		4
15	Locate the fault in electrical installation		4
Skill Assessment			2
Total Hrs			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Not Applicable

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Not Applicable

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram/selection of equipment's/writing procedure etc.	10
2	Performance	20
3	Result	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	3	3	-	-	3	3	3	-	-
2	-	-	3	3	3	-	-	3	3	3	-	-
3	-	-	3	3	3	-	-	3	3	3	-	-
4	-	-	3	3	3	-	-	3	3	3	-	-
5	-	-	3	3	3	-	-	3	-	3	-	-
6	-	-	-	-	3	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Electrical Design Estimating and Costing	K.B. Raina and Dr. S.K. Bhattacharya, New Age International (P) Ltd. (2010)	10: 8122403638 13: 978-8122403633
2.	Study of Home Appliances	K. B. Bhatiya, Khanna Publication 2010 Edition.	1234567146703
3.	Home Appliances Servicing	E.P. Anderson, Audels	030114

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/108108076/1> , assessed on 18th January 2016
- <http://www.electrical4u.com> , assessed on 18th January 2016
- <https://www.youtube.com/watch?v=A9KSGAnjo2U>, assessed on 18th January 2016
- <http://www.electricaltechnology.org/2015/09> assessed on 30 Jan 2016
- www.slideshare.net/bawaparam/made-by-param assessed on 30 Jan2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Electrical Maintenance Tool Kit.
2. Megger 500V Hand driven
3. Earth tester 3 spike.
4. Digital Multi-meter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. C.S.Thorat	Principal	Government Polytechnic, Nagpur.
2.	K.M.Gaidhane	I/C, Head of Electrical Engineering	Government Polytechnic, Nagpur.
3.	R.I.Kamble	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
4.	S.P.Thote	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
5.	Dr. R.S.Surjuse	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
6	G.V.Gotmare	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
7	H,N.Kharkar	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
8	N.H.Adkine	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
9	A.P. Gandhi	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
10	Bhashkar Bale	Dy. Executive Engineer,	MSTCL, Nagpur
11	R.Y.Ghormade	Head of Electrical Engineering	Dharampeth Polytechnic, Nagpur
12	DR. S.S.Bharatkar	Lecturer in Electrical Engineering	Government Polytechnic, Amaravati.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/EE/ME/CM/IT/PK/AE/TX/TR
LEVEL NAME	: PROFESSIONAL ELECTIVE
COURSE CODE	: FE504E
COURSE TITLE	: HOBBY ELECTRONICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: NIL
PR. TEE EXAM	: 02 HRs
PT. EXAM	: NIL

❖ RATIONALE:

Some students may be interested in interdisciplinary approach therefore it is felt that diploma holder those who have interest in "Hobby Electronics Circuits" must have minimum competency and knowledge of it, so later on some student may take up it as business. Therefore this course has been kept as one of free elective interdisciplinary course in the curriculum.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

- 1 Identify different electronics components.
- 2 Handle electronics circuit development tools & test and measuring equipments.
- 3 Select the hobby electronics circuits as per requirements.
- 4 Test the electronics components and circuits.
- 5 Develop the simple electronics hobby project.
- 6 Present electronics project.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Hrs.
1	Identify and understand different electronics components. -like. resistor, capacitor, inductor, diode, transistor, relay etc.	04
2	Observe and draw Symbols and unit of measurement for electronics parameters like voltage, current, resistor, capacitor, inductor etc.	04
3	Identify the applications of basic electronics test and measuring equipments. Like multimeter LCR meter, Cathode Ray Oscilloscope, Function generator etc.	08
3	Perform the basic handling skill of electronics circuit development tools like soldering gun, de-soldering pump etc	04
4	Test different electronics components like resistor, capacitor, inducer, diode, relay etc.	08
5	Identify simple electronics Hobby circuits by referring journals, websites, and hobby electronics manuals.	04
6	Arrange electronics component and PCB (general purpose) for selected circuit and their testing.	08
7	Prepare component layout of selected electronics circuit.	04
8	Mount and solder electronics components on PCB (general purpose)	08
9	Perform Testing, fault finding, rectification of fault. of circuit.(Test the circuit for performance and rectify the fault)	06
10	Perform the final testing of circuit & packaging.	04
Skill Assessment		02
Total Hrs		64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

NIL

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER**

NIL

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
2	Performance–Demonstration of project work	25
5	Viva voce	25
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-			-	-		3	-	3	-	-
2	-	-	3	3	-	-	3	3	-	3	-	-
3	-	-			-	-	3	3	-	3	-	-
4	-	-	3	3	-	-		3	-	3	-	-
5	-	-	3	3	-	-	3	3	-	3	-	-
6	-	-	3	3	-	-		3	1	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Electronic For You	Journal	--
2.	Electronics Material And Components	Dr. MadhuriA. Joshi, , Shroff Publisher & Dist. Pvt. Ltd. 3 rd Edition,	10: 8173669007 13: 9788173669002
3.	Data Books Of Electronic Components & Devices	Business Promotion Bureau	--

❖ **E-REFERENCES:**

- ❖ Websites www.electronicprojects.com , assessed on 4th May 2016
- ❖ Websites www.circuittoday.com assessed on 4th May 2016
- ❖ Websites www.electroschematics.com assessed on 4th May 2016
- ❖ Websites www.hobbyelectronics.in assessed on 4th May 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Digital Multi-meter
2. LCR-Q meter
3. Cathode Ray Oscilloscope
4. Soldering Gun.
5. De-soldering Pump.
6. Nose Plier

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	S.S.Tadas	HOD, Electronics Telecomm. Engg.	Government Polytechnic, Nagpur.
2.	A.A.Ali	Lecturer (Selection Gr.) Electronics Telecomm. Engg.	Government Polytechnic, Nagpur.
3.	D.A.Brahmankar	Lecturer (Selection Gr.) Electronics Telecomm. Engg.	Government Polytechnic, Nagpur.
4.	U.M.Ramteke	Lecturer (Selection Gr.) Electronics Telecomm. Engg.	Government Polytechnic, Nagpur.
5.	Mr. Sandip V Darwhekar	Director	Beta Computronics Pvt Ltd , Nagpur
6.	Mrs. Gazzala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
7.	Mr S M Kale	Lecturer Electronics	Government Polytechnic, Gadchiroli.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/IT/CM/AE/MT/TX
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE505E
COURSE TITLE	: BASIC PACKAGING TECHNOLOGY
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT =2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ **RATIONALE:**

Packaging is the need of every manufactured commodity. Safe delivery of product to end user through package has got many expectations. Packaging has a various functions and aspects. Packaging process starts as soon as finished product is ready. The package with the product is subjected to various situational hazards. The success of packaging largely depends on how these hazards have been considered and taken care of. This all requires a panoramic or holistic view about the field of packaging.

The concept & technology of packaging has taken years together to develop to where it is today, through evolution of technology, market and business. In spite of being a value to the business and developing economy, packaging by virtue of consuming resources, creating solid waste and pollution, is posing a grave threat to the environment.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to -

1. Collect various primary and secondary packages.
2. Identify the packaging materials and appreciate their properties.
3. Identify product characteristics of a packaged product.
4. Estimate the hazards to the package along with its contents.
5. Record by testing/ measurement/ observation various parameters of a package.
6. Search web resources on environmental issues related with packaging.

❖ **COURSE DETAILS:****A. THEORY :**

Unit Number and Name	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Introduction to Packaging. - Form suitable number of groups of students. - Collect 05 empty packages/ containers of different products. (Primary & Secondary packages) Products may be assigned by the course teacher. - Prepare a list of the packages and the products they contained. - Submit the list along with the collection.	Introduction	02
2.	Assort the collection of various packages by the class into primary and secondary packaging. - Classify the collected packages into Primary, Secondary & Primary as well as Secondary packaging. - Classify the collected packages into Rigid, semi-rigid and flexible packaging. - Note down the classification. - Identify the material/ materials of the packages. - Measure the physical parameters/ characteristics of the packages/ packaging material such as dimensions, weight, thickness, size, etc. - Prepare a power point presentation on it. - Attach the print out of above presentation in the Journal.	Packaging Materials	12
3.	Identify the product properties/ characteristics and estimate packaging functions. - Select appropriate number of products from the collection. - Identify various physical/ physiochemical properties of the products influencing its packaging. - Predict the functions of the packaging material and the package. - Classify predicted functions into Technical/ Primary and Commercial/ Secondary functions of packaging. - Prepare a brief report on it and attach in the Journal.	Product Characteristics	10
4.	Identify the fitness for use of the product contain by its packaging.		

	• Collect at least one package each of – one Perishable food and one Pharmaceutical Product. • Examine the date of manufacture, expiry/best before. • Note down above information and collect the information on usage of unfit products.	Packaging Communication	04
5.	Judge the hazards of handling, warehousing and transportation. • Observe the printed communication on the package and find out the manufacturer and its geographical location. • Trace out the method of handling, warehousing and transportation. • Outline the distribution channel. • Estimate the hazards to the products and packaging due to of handling, warehousing and transportation. • Interpret material handling instructions as printed on the packaging. • Write a report.	Packaging Hazards	12
6.	Carryout following tests on packaging materials and dummy packages. • Drop test. [IS : 7028 (Part 4) – 1987] • Puncture resistance test. (T 803 om-88) • Rolling test [IS : 7028 (Part 5) – 1987] • Vibration test. IS : 7028 (Part 2) - 2002 • Box compression test. (T 804 om-89) • Analyse the test results.	Package Testing	10
7.	Conduct a Survey/ Case study on environmental burdens caused by Packaging. • Select a Packaging Industry. • Visit to the industry or search information through web resources. • Gather information on different operations performed by the industry. • Study the impact of those operations on environment. • Appreciate 3-R concept (Reduce, Reuse and Recycle) • Prepare presentation.	Survey	12
Skill Assessment			02
Total			64

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
	Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6
End Of Course		End Of The Course	Questionnaires					

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Identification	10
2	Drawing / flowchart/schematics/symbols	10
3	Procedure/involvement/performance	10
4	Viva voce	20
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	-	-	-	-	3	3	3	-	-
2	-	-	-	-	-	-	-	3	3	3	-	-
3	-	-	-	-	-	-	-	3	3	3	-	-
4	-	-	3	-	-	-	-	3	3	3	-	-
5	-	-	3	2	-	-	2	3	3	3	-	-
6	-	-	-	-	1	1	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Fundamentals Of Packaging	F.A. Paine, Newnes-Butterworth, 1973	13: 9780408001076
2.	Packaging users Handbook	F.A. Paine, Springer; 1991	13: 9780751401516
3.	The Packaging Media	F.A. Paine, Blackie Academic & Professional, 1977	13: 9780216901919
4.	Packaging In The Environment	edited by Geoffrey M. Levy	13: 9780751400915
5.	The Wiley Encyclopedia of Packaging Technology.	Marilyn Bakker, John Wiley & Sons Inc. Canada	0471-80940-3
6.	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, 2E, PHI LPL, Delhi, 2014	978-81-203-5054-0

❖ **E-REFERENCES:**

1. <http://www.iip-in.com/site/default.aspx>
2. <https://books.google.co.in/books?isbn=0470541385>
3. <http://pkt.jinakarn.com/ept.pdf>
4. <http://www.boschpackaging.com/en/pa/homepage/homepage.html>
5. <https://www.youtube.com/watch?v=LbxXpP9ysjo>

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Bursting Strength tester
2. Box compression strength tester
3. Drop tester
4. Universal testing machine
5. Puncture testing machine
6. Edge compression tester

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Prof. R.S.Raool	I/C, Head of Packaging Technology	Government Polytechnic, Nagpur.
2.	Prof. A.S.Bhagat	Lecturer in Packaging Technology	Government Polytechnic, Nagpur.
3.	Prof. Imran K.Syed	Lecturer in Packaging Technology	Government Polytechnic, Nagpur.
4.	Prof. A.P.Pardey	Lecturer in Paper and pulp	Government Polytechnic, Nagpur.
5.	Prof. S.N.Madhugiri	Academician, Ex Principal & Retired Head of	Dharmapeth Polytechnic Nagpur & Dept. Packaging Technology G.P.Nagpur
6.	Prof. P.P Sargaonkar	Consultant & Retired Lecturer in Packaging Technology	Government Polytechnic, Nagpur.
7.	Prof. M.S.Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering	Government Polytechnic, Bramhapuri.
8.	Shri. Suresh Thakur	Industry Expert, Managing Director,	Palekar Food Products, MIDC, Amravati.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/PK/TX
LEVEL NAME : ELECTIVE COURSES
COURSE CODE : FE506E
COURSE TITLE : INDUSTRIAL METALLURGICAL PRACTICES
PREREQUISITE : NIL
TEACHING SCHEME : TH: 00; TU: 00; PR: 04(CLOCK HRS.)
TOTAL CREDITS : 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM : NIL
PR. TEE EXAM : 02 HRS (Internal)
PT. EXAM : NIL

❖ RATIONALE:

A technician comes across the various problems in metallurgical industries. Also, at the work place, it is always necessary, to tackle the problem so that the sound metallurgical product can be obtained by application of suitable metallurgical engineering techniques. Hence, the basic knowledge of various industrial metallurgical practices is necessary for a technician. This course helps to impart the basic knowledge to technician for increasing the productivity and a sound metallurgical product.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Draw sketches of different tools/machines in metallurgical shops/labs
2. Use of tools and machinery in different metallurgical labs/shops.
3. Operate different equipments/machineries used in basic Metallurgical labs/shops
4. Perform inspection and testing of metallurgical products.
5. Prepare sample for microscopic examination.
6. Choose proper tool for different metallurgical processes.

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Observe the demonstration of hand tools, machine Tools and equipments used in pattern making and mouldings shops and draw the sketches and write specifications, details, applications of above tools.	Pattern making and Moulding	02
2.	Prepare sand mould by using any one pattern (mould to be prepared by group of 2 to 4 students depending on volume of work)		08
3.	Observe the demonstration of hand tools, machine Tools and equipments used in casting shop and draw the sketches and write specifications, details, applications of above tools.	Casting	02
4.	Prepare one casting related to mould prepared. (any one type of casting to be prepared by group of 2 to 4 students depending on volume of work)		08
5.	Observe the demonstration of hand tools, machine Tools and equipments used in metal working operations (rolling, wire drawing, etc) and draw the sketches and write specifications, details, applications of above tools.	Metal working	02
6.	Perform practical related to any one metal working operations		08
7.	Observe the demonstration of hand tools, machine Tools and equipments used in heat treatment Shop and draw the sketches and write specifications, details, applications of above tools.	Heat treatment	2
8	Prepare sample for Performing heat treatment operation and conduct any one heat treatment to steel/cast iron sample		8
9	Observe the demonstration of hand tools and equipments used in testing and inspection lab and draw the sketches and write specifications, details, and applications of above tools.	Testing and inspection	2
10	Carry out various necessary testing and write the test report for any one metallurgical product.		8
11	Observe the demonstration of hand tools, machine Tools and equipments used in metallographic lab and draw the sketches and write specifications, details, applications of above tools.	Metallography	2
12.	Prepare one sample for metallographic examination and examine the sample under metallurgical microscope and draw the structure.		8
Skill Assessment			4
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Nil

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
	Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6
End Of Course		End Of The Course	Questionnaires					

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing diagram/ selection of equipment's/ writing procedure etc.	10
2	Performance	20
3	Calculation/Result/ Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	-	3	-	-	-	3	-	3	-	-
2	-	-	3	3	-	-	-	3	3	3	-	-
3	-	-	3	3	-	-	-	3	3	3	-	-
4	-	-	3	3	-	-	-	3	3	3	-	-
5	-	-	3	3	-	-	-	3	3	3	-	-
6	-	-	3	3	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Principles of metal castings	Dr. P.C. Mukharjee	81-20300716-X
2.	Foundry Engineering	Shrinivasan	81-7409-026-6
3.	Introduction to Physical Metallurgy	Sidney H. Avner McGraw-Hill international edition, 2 nd edition	0-07-085018-6
4.	Testing of materials by	Prof. A.V.K. Suryanarayana.	81-20300716-X
5	The Testing & Inspection of Engineering materials,	H. E. Davis, G. E. Troxell, McGraw Hill	81-7409-026-6
6	Mechanical Metallurgy	George Dieter, McGraw Hill,	0-07-084453-4
7	Heat treatment Principles and techniques	T.V. Rajan , C.P. Sharma, Prentice Hall of India Pvt. Ltd, 12 th edition	81-20300716-X

❖ **E-REFERENCES:**

<http://books.google.co.in/books/isbn=9380026757> , assessed on

17th March 2016

<http://www.youtube.com/watch?v=101M1kaZIFg> , assessed on 27th April 2016

http://www.youtube.com/watch?v=1HuxDVpy_iv , assessed on 27th April 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Patterns
2. Foundry tools
3. Welding Transformer (Oil Cooled) Three Phase
4. Pit type furnace
5. Mould boxes
6. Crucibles
7. Muffle furnace
8. Mould shaking machine
9. Draw bench
10. Rolling mill
11. Grinder
12. Polishing machine
13. Hardness tester
14. Microscopes
15. NDT equipments

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	K.L.Meshram	Head of the Dept Department of metallurgical Engineering	Government Polytechnic, Nagpur.
2.	Ms. V.C. Humney	Lecturer in Metallurgical Engineering	Government Polytechnic, Nagpur.
3	S.M.Waikar	Lecturer Metallurgical Engineering	Government Polytechnic, Nagpur
4.	Y.Y. Mahajan	Assist. Professor , Metallurgy & Material Science	VNIT Nagpur
5	S.B.Varadpande	Managing director	Orange city alloys Pvt. Ltd Nagpur
6	Y. K. Gaiky	Lecturer Mechanical Engineering	Government Polytechnic, Sakoli

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/AE/MT/PK/TX
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE507E
COURSE TITLE	: COMPUTER NETWORK
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(TH/TU CREDIT = 00 CLOCK HR., 1PR CREDIT = 2 CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

The world in the information era has become network centric. A Computer networks has been growing with rapid technological progress. Computer communication through networking becomes essential part of our life. We can manage many application like Air Line Reservation, Railway Reservation, E-banking, E-Governance, On-Line shopping, E-learning etc. by clicking mouse button from our own place. Because of this, world become the global village. By considering importance of networking towards all aspects of our life, we here introduce basic concept of networks, network classification, network topologies, network devices, Transmission media, Network reference models, concept of TCP/IP.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify network and network topologies.
2. Connect and handle different networking devices.
3. Identify network architecture and physical media used to connect computers in network.
4. Identify E-Commerce and E-Governance website on the internet.
5. Use and share Network Recourses.
6. Use various Internet and Intranet Applications

❖ **COURSE DETAILS:****A. THEORY: NIL**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Identify different types of network.	1.Introduction to Computer network and topologies	2
2.	Identify different network topologies.		2
3.	Connect and identify different Transmission Media.		4
4.	Connect and identify different network controlling devices like hub, switches etc.		4
5.	Connect computers in star topology by using wired media and with any network device (eg. Hub)		4
6.	Install and configure LAN card.	2.Local Area Network	4
7.	Prepare a Straight Cable and Network Cross over Cable and test by Line Tester.		4
8.	Share different devices like printer, scanner etc. over LAN network.	3.Applications & Uses of Computer network	2
9.	Share a printer on a network & print a document on it from a different computer on a network		2
10.	Share files and directories from one computer to other computer on the network.		2
11.	Install Win Messenger on LAN network.		2
12.	Create ID on Win messenger.		2
13.	Communicate through Win Messenger over LAN network.		4
14.	Connect through WAN network	4.Wide Area Network	4
15.	Create Email-ID on any WAN software like Gmail, Rediff, Yahoo etc.		4
16.	Communicate through any WAN software.		4
17.	Search information on the internet.		2
18.	Identify different E-commerce website on the internet like amazon.com, ebay.com etc.	5.Concepts of E-Commerce	2
19.	Connect through any E-commerce website on the internet and learn the procedure to buy books.		2
20.	Identify different E-Governance website on the internet like irctc.co.in etc.	6. Introduction to E-Governance	2
21.	Connect through E-governance railway website on the internet and learn the procedure for online railway reservation.		2
Skill Assessment			4
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:NIL**❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:NIL**

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection, writing steps, installation etc.	10
2	Connection and configuration.	10
3	Performance	20
5	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	-	-	-	-	3	3	3	-	-
2	-	-	3	3	-	-	-	3	3	3	-	-
3	-	-	3	3	-	-	-	3	3	3	-	-
4	-	-	3	-	-	-	-	3	3	3	-	-
5	-	-	3	3	-	-	-	3	3	3	-	-
6	-	-	3	3	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Computer Networks	Andrew S Tannenbaum, Tata McGraw-Hill Edition, 2012	9780132126953
2.	Fundamentals of computer	E Balaguruswamy, Tata McGraw-Hill Education Pvt. Ltd., 2009	9780070141605
3.	Computer Basics	Micheal Miller, Tata McGraw-Hill Edition, 2012	0789734206
4.	Complete Reference Networking	Craig Zacker, Tata McGraw-Hill Edition	0132126958

❖ **E-REFERENCES:**

<http://www.pcworld.com/article/116583/article.html> , assessed on 20th April 2016

<http://www.computerstepbystep.com/computer-maintenance.html> , assessed on 20th April 2016

<https://www.youtube.com/watch?v=a0rEXzyX0-8>, assessed on 20th April 2016

❖ **LIST OF MAJOR COMPONENTS/DEVICES WITH THEIR SPECIFICATION.**

1. Operating System(Windows 98/2000/XP/7/8/8.1/10)
2. CPU Intel core i3/i5/i7
3. Hub(4 port USB hub, TB-226)
4. Switches
5. Connectors(RJ45/BNC/AUI/FIBER)
6. Printers(INK JET/LASER)
7. Scanner(FLAT BED)
8. Crimps, Strips and cut tools(HT-200R, HT-2008R)

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Mr. S.P. Lambhade	Head of Computer Engineering	Government Polytechnic, Nagpur.
2	Dr. Mrs. A.R. Mahajan	Head of Information Technology	Government Polytechnic, Nagpur.
3.	Ms. Shifa S. Sayyed	Lecturer in Information Technology	Government Polytechnic, Nagpur.
4.	Mrs. V A Raje	System Analyst(Lecturer in Computer Engineering)	Government Polytechnic, Nagpur.
5.	Ms. Gayatri B. Chavan	Lecturer in Computer Engineering	Government Polytechnic, Nagpur.
6.	Shri. Atul Upadhyay	COE	Vista computers, Ramnagar, Nagpur
7.	Shri N. V Chaudhri	Asst. Professor (CSE)	DBACEO ,Wanadongri, Nagpur
8.	Shri Manoj Jethawa	HOD, Computer Science	Shri DattaMeghe Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA INCE/ME/EE/EC/PK /TR/AE/TX/MT
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE508E
COURSE TITLE	: PC ARCHITECTURE AND MAINTENANCE
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT = 02 CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

As computers are heavily used for most of the activities like office automation, database management etc, the repair and maintenance of computer and its peripheral devices is becoming an essential part of the information technology. This course will enable the student to assemble different types of computer system and maintenance of different supporting equipments like printer, scanner, etc.

❖ COURSE OUTCOMES:

After completing this course students will be able to –

1. Assemble and de-assemble computer system.
2. Perform different setting on various types of printers.
3. Install various types of software's.
4. Install operating system and device drivers in system.
5. Handle computer system hardware.
6. Maintain peripheral devices.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Identify all the peripheral devices.	1. Pc Motherboard And Its Components	2
2.	Identify all components mounted on motherboard.		2
3.	Perform Basic Input/output System (BIOS) setting and configuration setup using Complementary Metal Oxide Semiconductor (CMOS).		4
4.	Install CDRom drive to system.	2. Storage Devices And Interfacing	2
5.	Copy data on CD, DVD		2
6.	Install different types of cards such as Video Graphics Array (VGA) or Super Video Graphics Array (SVGA) display ,sound card ,LAN card, multimedia cards etc.	3.Display Devices And Interfacing	2
10.	Perform different printer settings on different types of printers. Write down the function of each switch.	4. Input And Output Devices	4
11.	Format, partition and install a Hard Disk Drive (HDD).		4
12.	Identify components of Hard Disk Drive (HDD) as a storage device.		2
13.	Connect scanner, scan documents and pictures on the scanner available in your lab. Sample printout be attached		4
14.	Install Internal and External Modem		4
16.	Per form Internet installation.		2
17.	Connect Switched Mode Power Supply (SMPS) and identify different parts of SMPS.	5. Power Supplies	4
18.	Connect Uninterrupted Power Supply (UPS) and write down function of it.		2
19.	Connect speakers and microphones to system.		2
20.	Assemble, de-assemble computer system.	6.Troubleshooting And Tools	4
21.	Identify installed computer peripherals and test their working using diagnostic software		4
22.	Find faults related to Monitor, CPU, Hard disk, Printer and other peripherals.		4
23.	Form a pico based net using Bluetooth devices and transfer data.		4
24.	Create bootable CD and Install an operating system		2
Skill Assessment			4
Total hours			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:NIL**❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:NIL**

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Writing steps, selection, procedure	10
2	Performance	20
3	knowledge/block diagram/connection	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	3	-	-	-	3	3	3	-	-
2	-	-	3	3	-	-	-	3	3	3	-	-
3	-	-	3	3	-	-	-	3	3	3	-	-
4	-	-	3	3	-	-	-	3	3	3	-	-
5	-	-	3	3	-	-	-	3	3	3	-	-
6	-	-	3	3	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Upgrading and repairs PCS	Pearson, Scott Mueller, 20 th Edition, 2012	13: 9780789747103
2.	Troubleshooting Your PC	Mr. David Stone & Alfred Poor, Prentice Hall India, 2000	13: 9780735614901
3.	A+ Complete	David Groth, BPB Publication, 2006	13: 9780782128024
4.	Computer Installation and Servicing	Balasubramaniam, Tata McGraw Hill Education Pvt. Ltd, Reprint, 2011	13: 9781259082467

❖ **E-REFERENCES:**

<http://www.pcworld.com/article/116583/article.html> , assessed on 26th April 2016

<http://www.computerstepbystep.com/computer-maintenance.html> , assessed on 26th April 2016

<https://www.youtube.com/watch?v=a0rEXzyX0-8>, assessed on 26th April 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Operating System(Windows 98/2000/XP/7/8/8.1/10)
2. CPU Intel core i3/i5/i7
3. Fiber optics cable(LSFH Polymer)
4. Unshielded Twisted pairs cable(CAT 1 to CAT5)
5. Connectors(RJ45/BNC/AUI/FIBER)
6. Printers(INK JET/LASER)
7. Scanner(FLAT BED)
8. Crimps, Strips and cut tools(HT-200R, HT-2008R)

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. Mrs. A.R. Mahajan	Head of Information Technology	Government Polytechnic, Nagpur.
2	Mr. S.P. Lambhade	Head of Computer Engineering	Government Polytechnic, Nagpur.
1.	Ms.I.G.Lokhande	Lecturer in Information Technology	Government Polytechnic, Nagpur.
2.	Mrs.V.A.Raje	Lecturer in Computer Engg.	Government Polytechnic, Nagpur.
3.	Mrs.D.P.Chanmanwar	Lecturer in Information Technology	Government Polytechnic, Nagpur.
4.	Shri. Atulupadhyay	COE	Vista computers, Ramnagar, Nagpur
5.	Shri N. V Chaudhri	Asst. Professor (CSE)	DBACEO ,Wanadongri, Nagpur
6	Shri Manoj Jethawa	HOD, Computer Science	Shri Datta Meghe Polytechnic, Nagpur

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GOVERNMENT POLYTECHNIC, NAGPUR.

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/AE/PK/MT/EC/IT/CM /TR
LEVEL NAME	: FREE ELECTIVE COURSES
COURSE CODE	: FE509E
COURSE TITLE	: FABRIC SELECTION AND CARE
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH. TEE EXAM	: NIL
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: 01 HR

❖ RATIONALE:

Clothes are as important as food and shelter. You use them for covering, protecting and even decorating yourself. You must be having different types of clothes for different occasions like your casual attire, office wear, party dresses, and your night suit and so on. In this course technology and science behind selection of right fabric and its care is illustrated.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Judge the fibres by means of a physical test.
2. Select the yarn and fabric.
3. Illustrate and draw care labels in Textiles.
4. Identify the different methods for different stain removal from textiles.
5. Perform stain removal on fabric.
6. Suggest precaution for storage of textiles.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
NIL			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practic als	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Prepare textile fibre classification chart.	Fibre	4
2.	Detect the fibre type by means of physical test.		6
3.	Select the different types of yarn and fabric	Yarn	4
4.	Prepare chart of classification of yarn with their end uses.		6
5.	Identify different fabric formation methods.	Fabric	4
6.	Draw the plain and twill weaves on graph paper.		6
7.	Judge quality of textiles based on fibre, yarn and weave.	Selection of Textiles	4
8.	Prepare a chart of removal of different types of stain in a fabric and		6
9.	Perform stain removal on a given fabric.	Care of Textiles	4
10.	Draw care label symbols with instructions for fabrics.		6
11.	Collect 10 garment samples and note the care labels instructions	Maintenance of textiles	4
12.	Prepare the list of precautions necessary for storage of textiles.		6
Skill Assessment			4
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Nil

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF JOB EVALUATION:**

S.N.	Description	Max. Marks
1	Chart preparation	10
2	Analysis of fabric samples	20
3	Draw symbols/diagrams / sketches	10
4	Viva voce	10
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	3	-	-	-	3	3	3	-	-
2	-	-	3	3	-	-	-	3	3	3	-	-
3	-	-	3	3	1	-	-	3	3	3	-	-
4	-	-	3	3	-	-	-	3	3	3	-	-
5	-	-	3	3	-	-	-	3	3	3	-	-
6	-	-	3	3	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Textile Fabrics:: Their Selection And Care From The Standpoint Of Use, Wear, And Launder ability,	George Henry Johnson : Harper & Brothers (1927)	B000863N32
2	Textiles	Sara J. Kadolph, Pearson Prentice Hall, 2007	0131187694, 9780131187696
3	Fabric Care	Noemia, D Souza : New Age international, 1998	978-81-224-1143-0
4	Fundamentals of Textile and their care	Sushila Dantiyagi : Orient Longman private limited, 2006	8125010270

❖ **E-REFERENCES:**

1. <http://www.textileassociationindia.org/> assessed on 20/9/2016
2. <http://www.fiber2fashion.org/>
3. <http://www.nift.ac.in/>
4. www.itamma.org/
5. <http://www.fabriclink.com/> assessed on 20/9/2016
6. <http://download.nos.org/srsec321newE/321-E-Lesson-22.pdf> assessed on 20/9/2016
7. <http://download.nos.org/srsec321newE/321-E-Lesson-26.pdf> assessed on 20/9/2016

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Mr. D. S. Kulkarni	Head of Textile Department	Government Polytechnic, Nagpur.
2.	Dr. S. B. Muttagi	Lecturer in Textile Technology	Government Polytechnic, Nagpur.
3.	Mr. S. G. Gaikwad	Lecturer in Textile Technology	Government Polytechnic, Nagpur
4.	Dr. C. P. Kapse	Lecturer in Textile Technology	Government Polytechnic, Nagpur.
5.	Mrs. L. S. Chakraborty	Lecturer in Textile Technology	Government Polytechnic, Nagpur.
6.	Prof. G.S. Kakad	Head of Textile Department	JDIT, Yavatmal
7.	Mr. R.N.Yadav	President	RSR Mohota Spinning and Weaving Mill

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/CM/TX/MT/PK/IT/TR
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE510E
COURSE TITLE	: TWO AND FOUR WHEELER TECHNOLOGY
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

Today majority of people using a vehicle and it becomes a common need of daily life. Therefore, it is felt that one must have knowledge about the various systems and their functional importance and working in the context of automobile and its maintenance. The course aims to impart basic skills and understanding of two and four -wheeler systems basic components their working principle and basic maintenance procedure. Hence, this course has been offered for student of various diploma programme as one of the Allied Courses as “Credit Non-Exam Course”

❖ COURSE OUTCOMES:

After completing this course students will be able to–

- Identify various systems of two wheeler.
- Identify various systems of four wheeler.
- Use different tools required for preliminary maintenance of vehicle.
- Practice to drive two and four wheeler vehicle or simulator.
- Practice various technique and procedure for finding general fault and repair them
- Prepare a report on Motor Vehicle Rules, Road Signals safety and precautions etc.

❖ COURSE DETAILS:

❖ A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
NIL			

❖ **B. PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:**

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify the various systems of two wheeler and write report. Report includes- -Classification of two wheeler -Block diagram of various system of two wheeler -function of various systems.	Introduction to Automobile	04
2	Identify the various systems of four wheeler and write report. Report includes- -Classification of four wheeler -Block diagram of various system of four wheeler -function of various systems.		06
3	Use off hand tools and special tools required for maintenance of two and four wheeler vehicle.		06
4	Prepare a report on Motor Vehicle act and traffic signs. Reports includes- -Various motor act. -Driving license requirement. -Traffic signs. -Insurance of vehicle.	Motor Vehicle Act	10
5	Practice four wheeler driving training on simulator.		20
6	Identify below mention faults in two wheeler and repair them. 1) Starting Problem. 2) Mileage Problem. 3) Pick-up Problem. 4) Abnormal sound from Engine and Transmission System.	Fault finding and maintenance of Automobile	08
7	Identify below mention faults in Four wheeler and repair them. 5) Starting Problem. 6) Mileage Problem. 7) Pick-up Problem. 8) Abnormal sound from Engine and Transmission System.		08
Skill Assessment			02
Total hours			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:NIL**❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:NIL**

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing of Sketch, selection of equipment's, procedure etc.	20
2	Performance	10
3	Conclusion	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	-	-	-	-	-	3	3	3	-	-
2	-	-	-	-	-	-	-	3	3	3	-	-
3	-	-	-	3	3	-	-	3	3	3	-	-
4	-	-	3	3	3	-	3	3	3	3	-	-
5	-	-	3	3	3	3	-	3	3	3	-	-
6	-	-	-	-	3	3	3	3	3	3	-	-

1-Slight (Low) 2-Moderate (Medium) 3 –Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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, 2013	97881801419669
2	Automotive Mechanics	S. Srinivisan,Tata McGraw – HILL, 2nd Edition, 2003	9780070494916
3.	Basic Automobile Engineering	Nakra CP , Dhanpat Rai Publishing Company (P) Limited,2009	9788187433224
4.	Automotive Mechanics	S. Srinivisan,Tata McGraw – Hill, 2 nd Edition, 2003	9780070494916
5	The Motor vehicle Act	Goverment Publication, 1989.	Government Publication

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS**

- ❖ Air compressor-1 HP 3 phase, Max Pressure: 4, 95 kg/cm², 70 ltr.
- ❖ Engine Crane –Hydraulic, 2 ton Capacity.
- ❖ Bottle/Floor/Scissor Jacks- 3 ton Capacity.
- ❖ Two Post Lift- Capacity 3.5 Ton, Max Lifting ht - 1830 mm, Min Lowering height - 110 mm, Post height - 3700 mm Lifting time - 55 Secs, Width between posts : 2800 mm, with 1 HP / 2 HP power pack 1 or 3 phase
- ❖ Air hydraulic press - Capacity: 30 Ton. Air pressure: 100-140 PSI. 2 Press plates included (designs may vary) Air inlet fitting: 1/4" NPT
- ❖ Socket/ Impact wrenches- 1/4", 3/8", 1/2" and 3/4"
- ❖ Torque wrenches- 3/8", 1/2" and 3 NM, Ratcheting type/Click-type.
- ❖ Driving simulator.
- ❖ Road signs.
- ❖ Vehicle with two paddle control.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr.K.S.Dixit	I/C, Head of Automobile Engineering	Government Polytechnic, Nagpur.
2.	Mr. S.D.Thakre	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
3.	Mr. R.B.Tirpude	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
4.	Mr. Syed J.M.	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
5.	Mr. V.S.Kumbhar	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
6	Mr. A.R.Yadgire	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/AE/PK/MT/EC/IT/CM /TX
LEVEL NAME : FREE ELECTIVES
COURSE CODE : FE511E
COURSE TITLE : ENERGY CONSERVATION AND MANAGEMENT
PREREQUISITE : NIL
TEACHING SCHEME : TH: 00; TU: 00; PR: 04(CLOCK HRS.)
TOTAL CREDITS : 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE : NIL
PR. TEE : 02 HRS (Internal)
PT. : NIL

❖ RATIONALE:

Energy conservation is a scientific and basic tool to make balance in different forms of energies. This course imparts the awareness, knowledge and practical skills/ techniques of energy conservation in various sectors. After completion of this course diploma engineering students must use various techniques and methods of energy conservation. Also they should be able to perform energy audit and its implementation.

COURSE OUTCOMES:

After completing this course students will be able to–

1. Determine losses in Mechanical System
2. Use different methods of energy conservation
3. Collect information related to star rating equipment
4. Use energy conservation equipment for energy audit
5. Design efficient illumination scheme for energy conservation
6. Prepare energy audit report.

❖ COURSE DETAILS:

THEORY:

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

A. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs
1.	Use different dynamometers and tachometer for measurement of power of rotating shaft.	Mechanical Measurement	4
2	Use RDT PT100 thermal sensor and its module for measurement of temperature at different stages in IC engine.		2
3	Use anemometer and measure quantity of air supplied to IC Engine.		2
4	Determine Volumetric and overall efficiency of two stage reciprocating compressor by conducting trial on test rig.	Mechanical Performance Measurement	4
5	Determine overall efficiency of centrifugal pump and plot operating characteristics by using centrifugal test rig.		4
6	Calculate coefficient of performance by conducting trial on vapour compression refrigeration test rig.		4
7	Collect performance information of 5 stars and 2 stars, same brand split AC and compare the results in terms of energy consumption.	Basic of Energy Conservation	2
8	Calculate electric bill for electric water heating system. Compare it with cost of solar water heating system and calculate payback period of solar water heating system.		2
9	Connect voltmeter, ammeter and wattmeter in electric circuit to measure voltage, current and power required for energy audit.		2
10	Determine losses of single phase Transformer at No load, Half load and Full load by conducting load test.		2
11	Use power guard meter for measurement of different electrical quantities		2
12	Calculate payback period of energy efficient motor. Compare losses of energy efficient motor with similar capacity conventional motor.	Energy Conservation Methods	4
13	Calculate energy saving by using energy efficient equipments like automatic Star – Delta starter for three phase induction motor		4
14	Calculate energy saving in lighting system by retrofitting tube lights with LED lamps. Also calculate payback period.		4
15	Measure illumination level of different places with the help of Digital Lux Meter		4
16	Design illumination Scheme for any one of the following by using energy efficient luminaries; a) Flat b) Bungalow c) Independent House		4
17	Mini project Prepare Energy audit report of any institute/Industry/Hospital/Residence/small workshop.		4

18	Prepare report on visit to cogeneration system.		4
19	Prepare detail report and give presentation in the class on any one of the following topics , i) Energy conservation and Environmental issues ii) Market survey on energy efficient luminaries iii) Market survey on energy efficient motors and transformers. iv) Energy tariff system in India v) Energy conservation equipments vi) Energy Management vii) Energy Audit viii) Energy conservation act 2003		4
Skill Assessment			2
Total Hrs			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Not Applicable

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Not Applicable



❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipments, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	3	-	3	3	-	3	-	3	-	-
2	-	-	3	-	3	3	-	3	-	3	-	-
3	-	-	-	-	-	3	-	3	3	3	-	-
4	-	-	3	2	3	-	-	3	3	3	-	-
5	-	-	3	-	-	-	-	3	-	3	-	-
6	-	-	3	-	3	3	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Generation and Utilization of Electrical Energy	D.Srilatha S.Sivnagraju M.Balasubbareddy Pearson , New Delhi	8131798771, 9788131798775
2.	India – The Energy Sector	P.H. Hederson, University Press,	
3.	Energy management Handbook	W.CTurner, Wiley Press	10: 142008870X
4.	Efficient Use and management of electricity in industry.	B.G. Desai, J.S.Rana, A.V. Dinesh, R. Paraman, Devki Energy Consultancy PVT Ltd	
5.	Renewable Energy Technologies- A Practical guide for beginners	Chetan Singh Solanki, Prentice-Hall of India PVT. Ltd., First, 2008.	978-81-203-3434-2
6	Chetan Singh Solanki, Prentice-Hall of India PVT. Ltd., First, 2008.	Renewable Energy Technologies- A Practical guide for beginners	-978-81-203-3434-2-

7	Non-Conventional Energy Resources	D.S.Chauhan, S.K.Srivastava, New Age International (P) Ltd. Publishers, Second 2011.	13:978-81-224-1768-5
8	Renewable Energy Sources & Conversion Technology	N.K. Bansal, Kleemann, Meliss	0074600230, 9780074600238.
9	Illuminating Engineering	Kamlesh Roy, Laxmi Publication, 2006	9789380386553

❖ **E-REFERENCES:**

1. www.bee.india.nic.in , accessed on 11th November, 2016
2. www.mnes.nic.in , accessed on 11th November, 2016
3. www.energymanagertraining.com , accessed on 11th November, 2016
4. www.greenbusiness.com , accessed on 11th November, 2016
5. www.worldenergy.com , accessed on 11th November, 2016
6. www.mahaurja.com , accessed on 11th November, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Lux meter
2. Ammeter MI 0-5-10 A
3. Voltmeter MI 0-150-300 V
4. Wattmeter 0-3000 W
5. Digital Multi-meter
6. Rheostat assorted sizes
7. PV Solar panel
8. Energy efficient motors
9. Energy efficient transformer
10. Energy efficient luminaries
11. Energy efficient Equipments /Devices
12. Power Guard Meter (For measurement of V, I, W, VA, PF, KWh)

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. C.S.Thorat	Principal	Government Polytechnic, Nagpur.
2.	Mr. O. V. Sarode	I/C, Head of Mechanical Engineering	Government Polytechnic, Nagpur
3.	Mrs. K.M.Gaidhane	I/C, Head of Electrical Engineering	Government Polytechnic, Nagpur.
4.	Mr. A.R. Shaikh	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.

4.	Mrs.S.P.Thote	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
5.	Dr. R.S.Surjuse	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
6	Mr.G.V.Gotmare	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
7	Mr.N.H.Adikine	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
8	Bhashkar Bale	Dy. Executive Engineer,	MSTCL, Nagpur
9	R.Y.Ghormade	Head of Electrical Engineering	Dharampeth Polytechnic, Nagpur
10	DR. S.S.Bharatkar	Lecturer in Electrical Engineering	Government Polytechnic, Amaravati.

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/AE/PK/MT/EC/IT/CM /TX/TR
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE512E
COURSE TITLE	: LEARNING ABILITY DEVELOPMENT
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT =2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs (Internal)
PT.	: NIL

❖ RATIONALE:

Learning ability of an engineer or professional is essential through the level at which he/she has developed and persuades his/her hobby. It enhances the creativity. Hobby is integral and important part of human personality. Hobby is best for recreation which rejuvenates a person. To obtain maximum benefits from hobby the overall understanding and competency in performance is utmost important.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Develop learning ability through hobby.
2. Appreciate importance of hobby in developing learning ability.
3. Choose related equipments, consumables and gears.
4. Maintain related equipments.
5. Carry out setting of equipment.
6. Exhibit learning through performance.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Present following: Learning ability development through hobby.	Introduction	4
2	Collect information about present scenario of related field – Experts in India, Experts in your city	Awareness Development	4
3	Demonstrate different related equipments.	Demonstration	4
4	Demonstrate Performance.		4
5	Practice setting up related instruments	Practice	4
6	Practice performance –level I		20
7	Practice performance –level II		16
8	Practice tuning and preliminary maintenance of related instruments.		4
Skill Assessment			4
Total Hrs			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Not Applicable

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

Not Applicable

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignments		Continuous	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End Of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Printouts	1, 2, 3, 4,5,6
	Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6
End Of Course		End Of The Course	Questionnaires					

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Practical on setting up / tuning related instruments	10
2	Performance –level I	20
3	Performance –level II	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	-	-	-	-	-	-	-	-	-	3	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	3	3	-	3	-	3	3	3	-	-
4	-	-	3	3	-	3	-	3	3	3	-	-
5	-	-	3	3	-	3	-	3	3	3	-	-
6	-	-	3	3	-	-	-	3	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
NIL			

❖ **E-REFERENCES:**

- ❖ <https://en.wikipedia.org/wiki/Hobby>
- ❖ www.justdial.com/Nagpur/Hobby
- ❖ nagpur.quikr.com

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

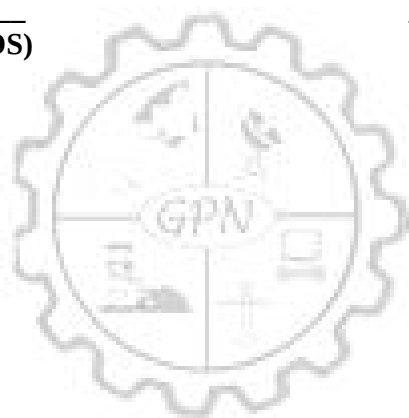
- ❖ As per requirement of related field.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. C.S.Thorat	Principal	Government Polytechnic, Nagpur.
2.	Dr. K.S.Dixit	Head of Automobile Engineering	Government Polytechnic, Nagpur.
3.	Mr. S.A.Telang	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
4.	Mr. R.B.Tirpude	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur
5.	Mr. J.M.Syed	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)



Vision of the Mechanical Engineering Program

Impart quality education to create world class Technical Professionals and Entrepreneur to meet the changing need of Industries and Society.

Mission of the Mechanical Engineering Program

- M1 :** To develop and deliver quality academic programs in Emerging field of Mechanical Engineering to empower the students to meet industrial needs with environmental concern.
- M2 :** To adopt the best Instructive methods to maximize knowledge transfer.
- M3 :** To provide the best facility, infrastructure and environment to the students and faculty members, creating an ambience conducive for excellence in Mechanical Engineering education.
- M4 :** To impart quality education to inculcate moral values, professional ethics and Entrepreneurial qualities.

Program Educational Objectives - PEOs

- PEO1** : To provide a strong background of science and humanities in order to use these tools in Mechanical Engineering.
- PEO2** : To develop the ability to demonstrate technical and administrative competence.
- PEO3** : To develop innovative ideas of recent technology for benefits of society with environmental concern.
- PEO4** : To attain professional excellence through life-long learning and produce supervisors who ensure ethical and moral behaviour.
- PEO5:** To develop the qualities of Entrepreneur and professional leader.

Program Specific Outcomes - PSOs

- PSO1** : Plan, Design, fabricate, test, operate mechanical systems and processes
- PSO2** : Apply modern tools in manufacturing or processing quality products

Program Outcomes

- PO1 : Basic Knowledge:** Ability to apply knowledge of basic Mathematics, Science and Engineering to solve the engineering problems.
- PO2 : Discipline Knowledge:** Ability to discipline specific knowledge to solve core and/or applied engineering problems.
- PO3 : Experiments and Practice:** Ability to plan and perform experiments and practices and use the results to solve engineering problems.
- PO4 : Engineering Tools:** Apply appropriate technologies and tools with understandings of limitations.
- PO5 : The Engineer and Society:** Demonstrate knowledge to assess the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
- PO6 : Environment and Sustainability:** Understand the impact of engineering solutions in societal and environmental context, and demonstrate knowledge and need for sustainable development.
- PO7 : Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
- PO8 : Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.
- PO9 : Communication:** An ability to communicate effectively.
- PO10: Life-long learning:** Recognise the need for, and have preparation and the ability to engage in independent and life-long learning in context of technological changes.



GOVERNMENT POLYTECHNIC

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