

OUTCOME BASED CURRICULUM 2016

Program Diploma in Electronics & Telecommunication Engineering



**Government Polytechnic,
Nagpur**

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

Mission of Institute

The mission of Government Polytechnic, Nagpur is-

- M1** : To frame institutional policies for effective implementation of teaching learning process
- 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 Electronics &
Telecommunication Engineering



by

Curriculum Development Cell,

Government Polytechnic, Nagpur

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DIPLOMA IN ELECTRONICS & TELECOMMUNICATION **ENGINEERING**

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TABLE OF CONTENTS

LIST OF FIGURES	XXI
LIST OF TABLES	XXII
CHAPTER 1 GOVERNMENT POLYTECHNIC, NAGPUR AN INTRODUCTION	
.....	1
1.1 History	1
1.2 Autonomy	1
1.3 Awards	2
1.4 Geographical Location of Nagpur City	2
1.5 Government Polytechnic, Nagpur Campus	3
CHAPTER 2 POLYTECHNIC EDUCATION SYSTEM	5
2.1 Higher Education System in India	5
2.1.1 Department of Higher Education, MHRD	7
2.1.2 All India Council for Technical Education (AICTE).....	7
2.1.3 National Board of Accreditation (NBA)	7
2.1.4 Higher and Technical Education, Government of Maharashtra.....	8
2.1.5 Directorate of Technical Education (DTE), Government of Maharashtra.....	8
2.1.6 Maharashtra State Board of Technical Education (MSBTE).....	9
2.2 Polytechnic Education System	9
CHAPTER 3 CURRICULUM DEVELOPMENT SYSTEM.....	11
3.1 Organizational Structure of GPN	11
3.2 Curriculum Development System	12

3.2.1	Governing Board (GB).....	13
3.2.2	Board of Studies (BOS).....	14
3.2.3	Program Wise Board of Studies (PBOS)	15
3.2.4	Advisory Board (AB).....	15
CHAPTER 4 OUTCOME BASED EDUCATION PHILOSOPHY		16
4.1	Outcome Based Education	16
4.2	KEY constituents of OBE	17
4.2.1	Vision	18
4.2.2	Mission.....	18
4.2.3	Graduate Attributes (GA's).....	18
4.2.4	Program Outcomes (PO's)	18
4.2.5	Program Educational Objectives (PEO's).....	19
4.2.6	Program Specific Outcomes (PSO's).....	19
4.2.7	Course Outcomes (CO's)	19
4.2.8	Specific Learning Outcomes (SLO's) or Learning Outcomes (LO's)	20
CHAPTER 5 BLOOM'S TAXONOMY.....		21
5.1	Introduction to Bloom's Taxonomy	21
5.2	Domains of Learning.....	22
5.2.1	Cognitive Domain	22
5.2.2	Psychomotor Domain.....	24
5.2.3	Affective Domain.....	25
5.3	Program Outcomes and Domains of Learning.....	27

CHAPTER 6 CURRICULUM REVISION PROCESS.....	28
6.1 Change Management.....	28
6.1.1 ADKAR Model for Change Management	29
6.1.2 Results of ADKAR Model	30
6.2 Curriculum Revision Process	30
6.2.1 Study of OBE Philosophy	31
6.2.2 Analysis of OBE curricula	31
6.2.3 Comparison with MSBTE Existing Curriculum	33
6.2.4 Study of NBA/AICTE/MSBTE Guidelines	35
6.2.5 Search Conference.....	37
6.2.6 Curriculum mapping	37
6.2.7 Institute Level Policies	38
6.2.8 Development of Curriculum Revision Model.....	42
6.2.9 Preparation of Action Plan	42
6.2.10 Analysis and Brain Storming at Program Level.....	45
6.2.11 Development of Vision, Mission and PEOs and Curriculum	45
6.2.12 Approval from AB, PBOS, BOS and GB	46
6.3 Curriculum Revision at a Glance	46
CHAPTER 7 MODEL COURSE CURRICULUM.....	47
7.1 Basic Information.....	47
7.2 Rationale.....	47
7.3 Course Outcomes (COs).....	48

7.4	Course Details: Theory.....	48
7.5	Course Details Practical	49
7.6	Specification Table.....	50
7.7	Question Paper Profile (QPP)	50
7.8	Assessment and Evaluation Scheme	51
7.9	Scheme of Practical Evaluation.....	53
7.10	Mapping of Course Outcomes with POs and PSOs	53
7.11	Reference & Text Books	54
7.12	E-References	54
7.13	List of Major Equipment's/Instruments with Specification	55
7.14	List of Experts & Teachers who Contributed for Curriculum	55
	CHAPTER 8 CURRICULUM DOCUMENT	56
8.1	Vision of Institute.....	56
8.2	Mission of Institute.....	56
8.3	Vision of Program	56
8.4	Mission of Program	57
8.5	Program Educational Objectives (PEOs)	57
8.6	Program Outcomes (POs).....	58
8.7	Program Specific Outcomes (PSOs)	58
8.8	Mapping of Vision, Mission, PEOs, POs, PSOs	59
8.8.1	Mapping of Vision and Mission.....	59
8.8.2	Mapping of Mission and PEOs	59

8.8.3 Mapping of PEOs and POs- PSOs	59
8.9 Identified Skills in Search Conference	60
8.9.1 Technical skills for Electronics & Telecommunication Engineering	60
Diploma Students.....	60
8.9.2 Generic skills for Electronics & Telecommunication Engineering Diploma Holder	61
8.10 2011 Curriculum Mapping with Program Outcomes (POs).....	62
8.10.1 Identified Gaps in 2011 Curriculum.....	64
8.11 Courses Identification	65
8.12 Program Structure	70
8.12.1 Program Structure Level I: General Studies	71
8.12.2 Program Structure Level II: Basic Science Courses	72
8.12.3 Program Structure Level III: Engineering Sciences and Technical Arts Courses	73
8.12.4 Program Structure Level IV: Professional Courses	74
8.12.5 Program Structure Level IV: Professional Courses (Project Courses)	75
8.12.6 Program Structure Level V: Elective Courses	76
8.12.7 Program Structure Level V: Elective Courses	77
8.12.8 Program Structure Abstract.....	78
8.13 Award of Class Courses	79
8.14 Curriculum at a Glance	80
8.15 Courses Flow Diagram.....	81

APPENDIX A CURRICULUM.....	82
-----------------------------------	-----------

LIST OF FIGURES

Figure 1.1. Location of Nagpur City.....	3
Figure 1.2. Government Polytechnic, Nagpur Campus	4
Figure 2.1. Higher Education System in India.....	5
Figure 2.2. Classification of Higher Education System in India	6
Figure 3.1. Organizational Structure of GPN	12
Figure 3.2. Curriculum Development System	12
Figure 4.1. Outcome Based Education Framework.....	17
Figure 4.2. Key Constituents of OBE	17
Figure 5.1. Human Being and Domains of Learning.....	21
Figure 5.2. Revised cognitive hierarchy Levels.....	23
Figure 5.3. Psychomotor hierarchy Levels	25
Figure 5.4. Affective Domain hierarchy Levels	26
Figure 5.5. Program Outcomes and Domains of Learning	27
Figure 6.1. Mapping of change management tools with ADKAR	29
Figure 6.2. GoPoNa Model.....	42
Figure 7.1. Course Code	47
Figure 8.1. Course Flow Diagram (Sample Path).....	81

LIST OF TABLES

Table 4.1. Difference between Course Outcomes and Course Objectives.	20
Table 5.1. Cognitive Domain Levels Action Verbs.....	23
Table 5.2. Psychomotor Domain Levels Action Verbs	25
Table 5.3. Affective Domain Levels Action Verbs	26
Table 6.1. Credits Comparison	31
Table 6.2. Credit Ratio TH:PR Comparison.....	32
Table 6.3. Courses Comparison	32
Table 6.4. Examination Scheme Comparison.....	32
Table 6.5. Comparison of Autonomous Curricula.....	33
Table 6.6. Comparison of Existing Curriculum-2011 with MSBTE-2012 Curriculum ..	34
Table 6.7. List of Existing Courses for Revision/Deletion etc.	34
Table 6.8. List of New Courses proposed.....	34
Table 6.9. Comparison of Examination Scheme with MSBTE Curriculum.....	34
Table 6.10. Abstract of Guidelines	35
Table 6.11. Curriculum mapping (Sample)	38
Table 6.12. Suggestive Curriculum at a Glance	41
Table 6.13. First Phase Action Plan.....	43
Table 6.14. Second Phase Action Plan	44
Table 6.15. Program Structure Level I (sample).....	45

Table 7.1. Course Details Theory (sample)	49
Table 7.2. Course Details: Practical (sample).....	49
Table 7.3. Specification Table (sample)	50
Table 7.4. Question Paper Profile (sample)	51
Table 7.5. Assessment and Evaluation Scheme (Sample)	52
Table 7.6. Scheme of Practical Evaluation (Sample)	53
Table 7.7. Mapping of COs with POs and PSOs (Sample)	53
Table 7.8. Reference & Text Books (Sample).....	54
Table 8.1. Mapping of Vision-Mission.....	59
Table 8.2. Mapping Mission-PEOs.....	59
Table 8.3. Mapping PEOs-POs & PSOs.....	59
Table 8.4. 2011 Curriculum Mapping with POs & PSOs.....	62
Table 8.5. Courses Identification from Identified Skills.....	65
Table 8.6. Program Structure Level I: General Studies	71
Table 8.7. Program Structure Level II: Basic Science Courses	72
Table 8.8. Program Structure Level III: Engineering Sciences and Technical Arts Courses	73
Table 8.9. Program Structure Level IV: Professional Courses.....	74
Table 8.10. Program Structure Level IV: Professional Courses (Project Courses)	75
Table 8.11. Program Structure Level V: Elective Courses.....	76
Table 8.12. Program Structure Level V: Elective Courses.....	77
Table 8.13. Program Structure Abstract	78

Table 8.14. Award of Class Courses.....	79
Table 8.15. Curriculum at a Glance	80

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.

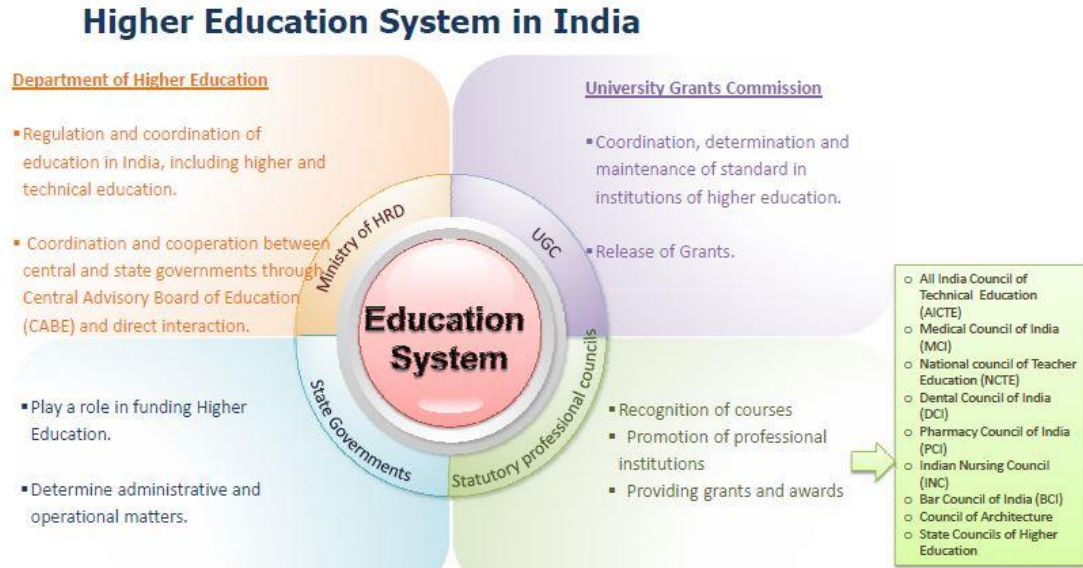


Figure 2.1. Higher Education System in India

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

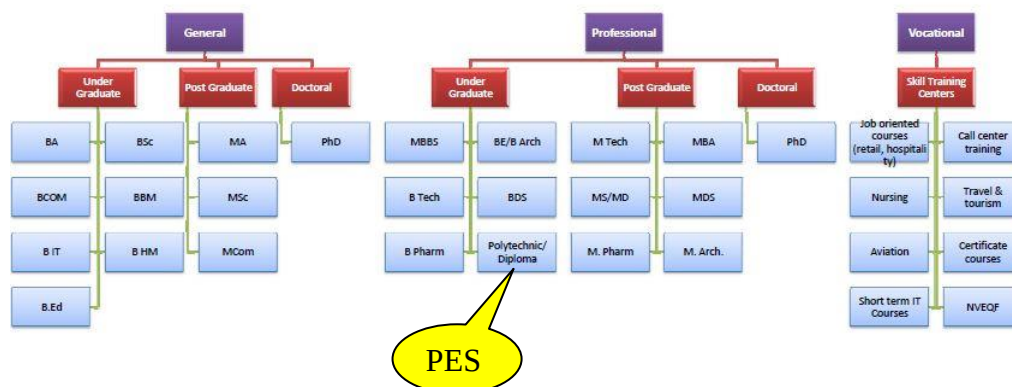


Figure 2.2. Classification of Higher Education System in India

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.

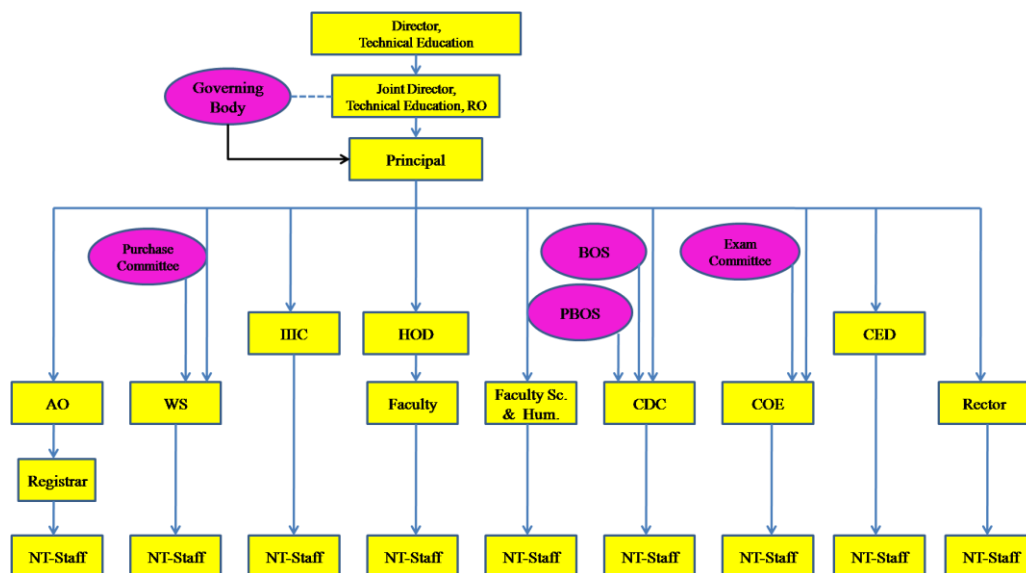


Figure 3.1. Organizational Structure of GPN

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.

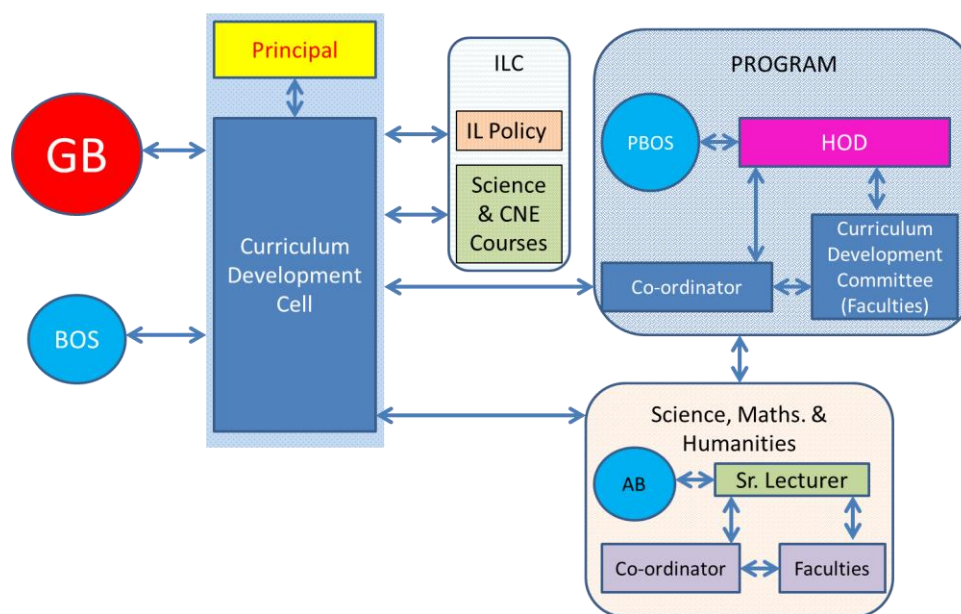


Figure 3.2. Curriculum Development System

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?

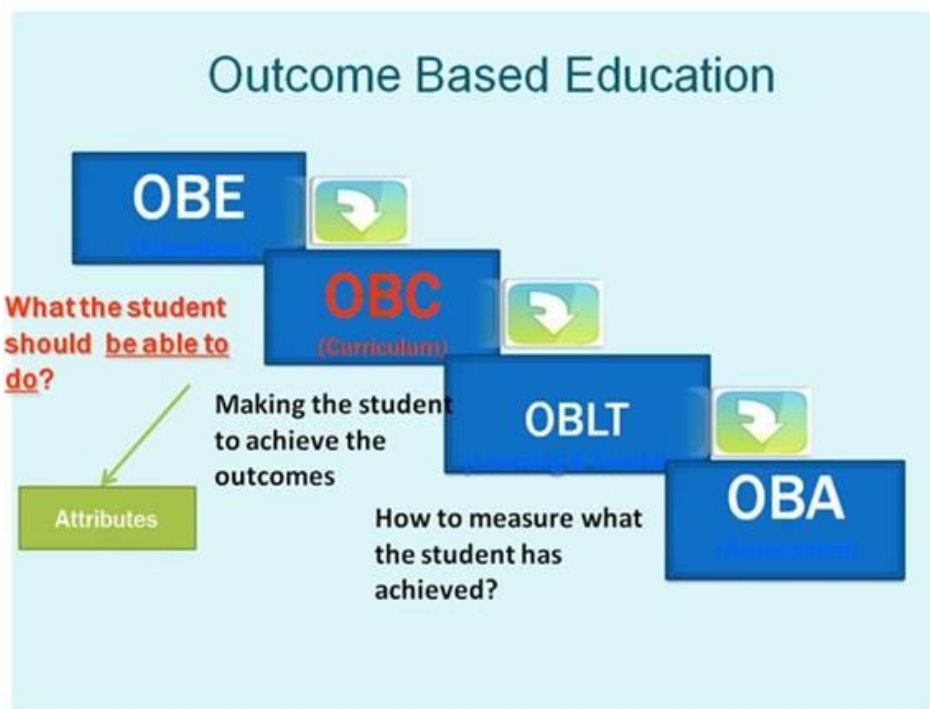


Figure 4.1. Outcome Based Education Framework

4.2 KEY constituents of OBE

Figure 4.2 shows the key constituent of OBE.

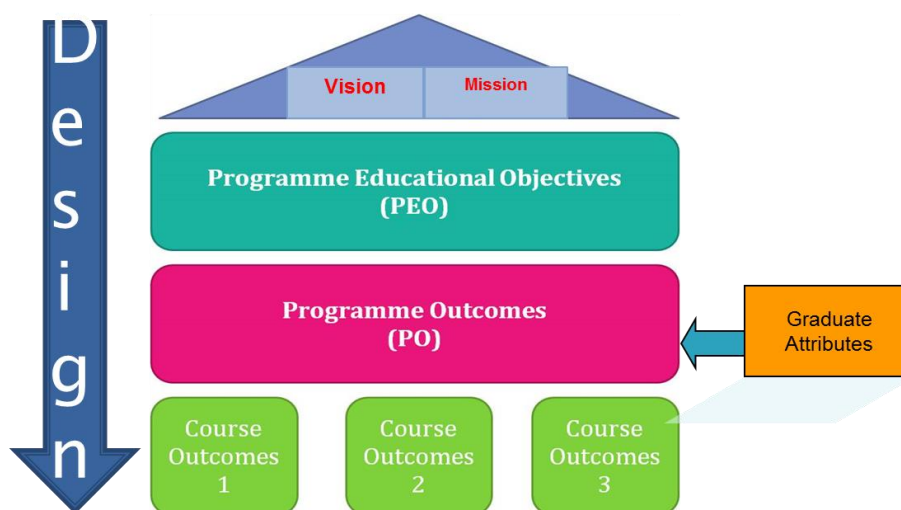


Figure 4.2. Key Constituents of OBE

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.

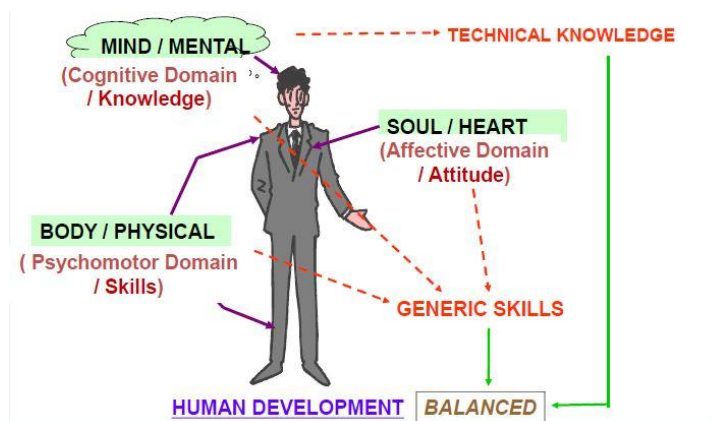


Figure 5.1. Human Being and Domains of Learning

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.

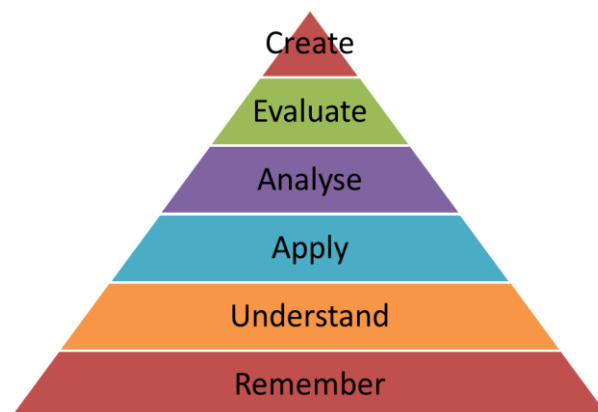


Figure 5.2. Revised cognitive hierarchy Levels

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.

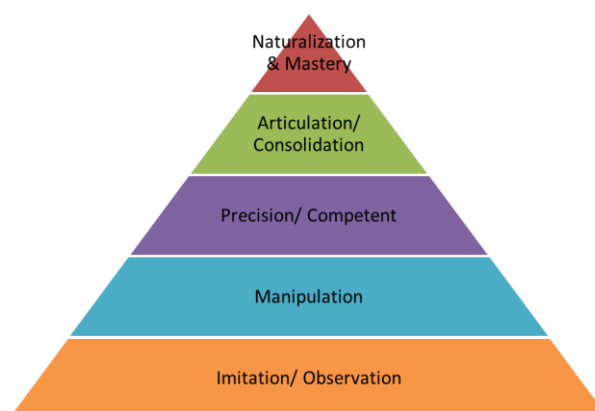


Figure 5.3. Psychomotor hierarchy Levels**Table 5.2. Psychomotor Domain Levels Action Verbs**

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.

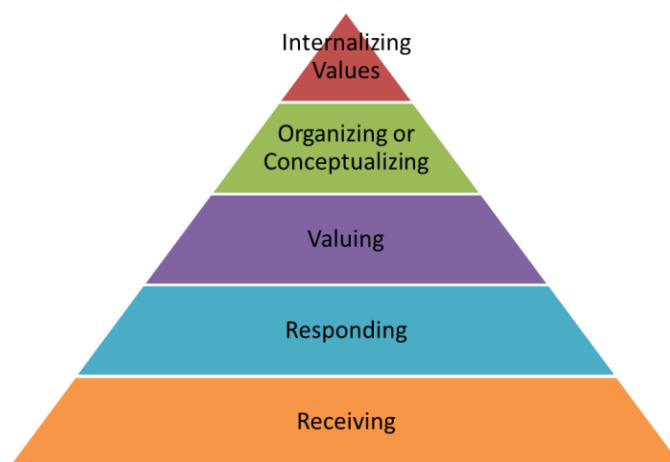


Figure 5.4. Affective Domain hierarchy Levels

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

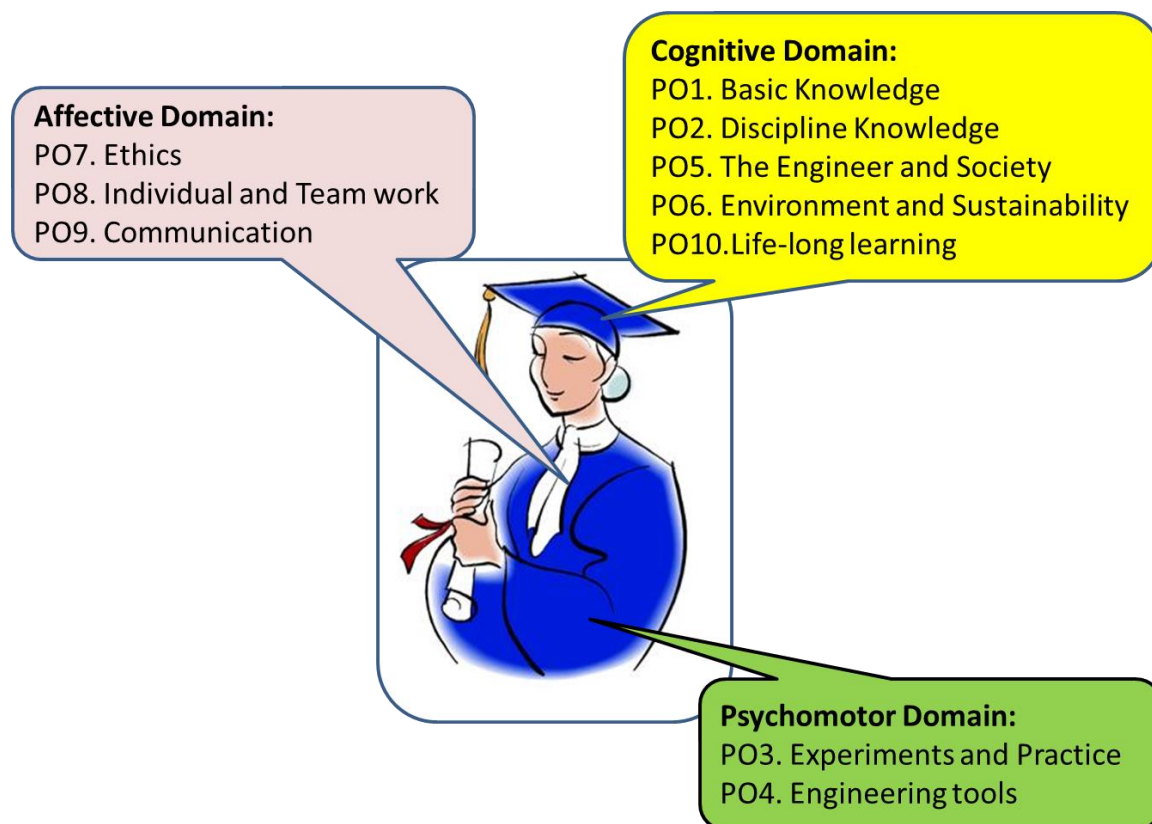


Figure 5.5. Program Outcomes and Domains of Learning

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.

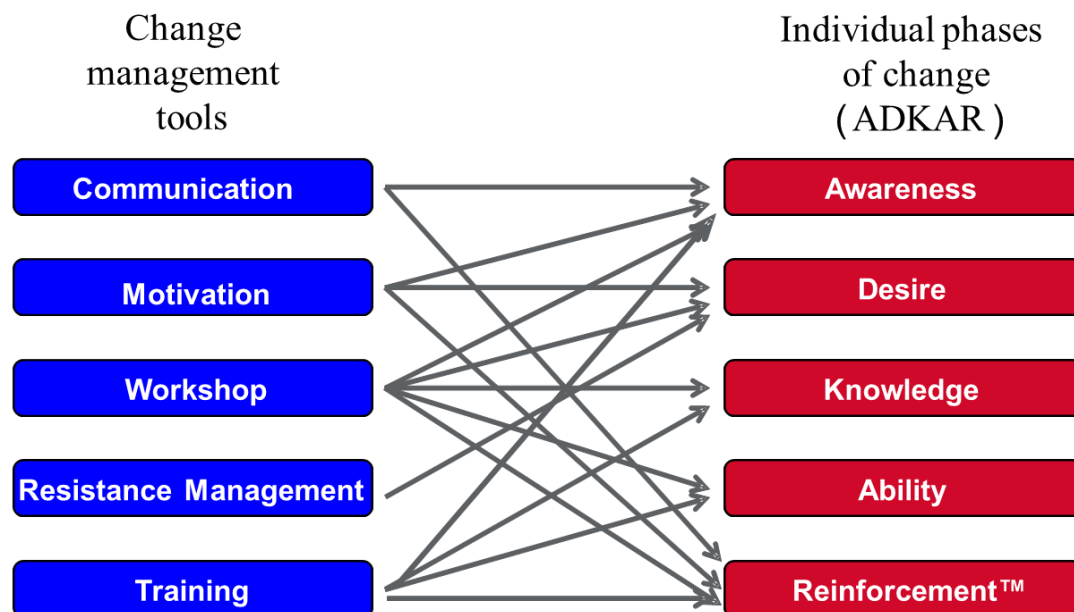


Figure 6.1. Mapping of change management tools with ADKAR

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.

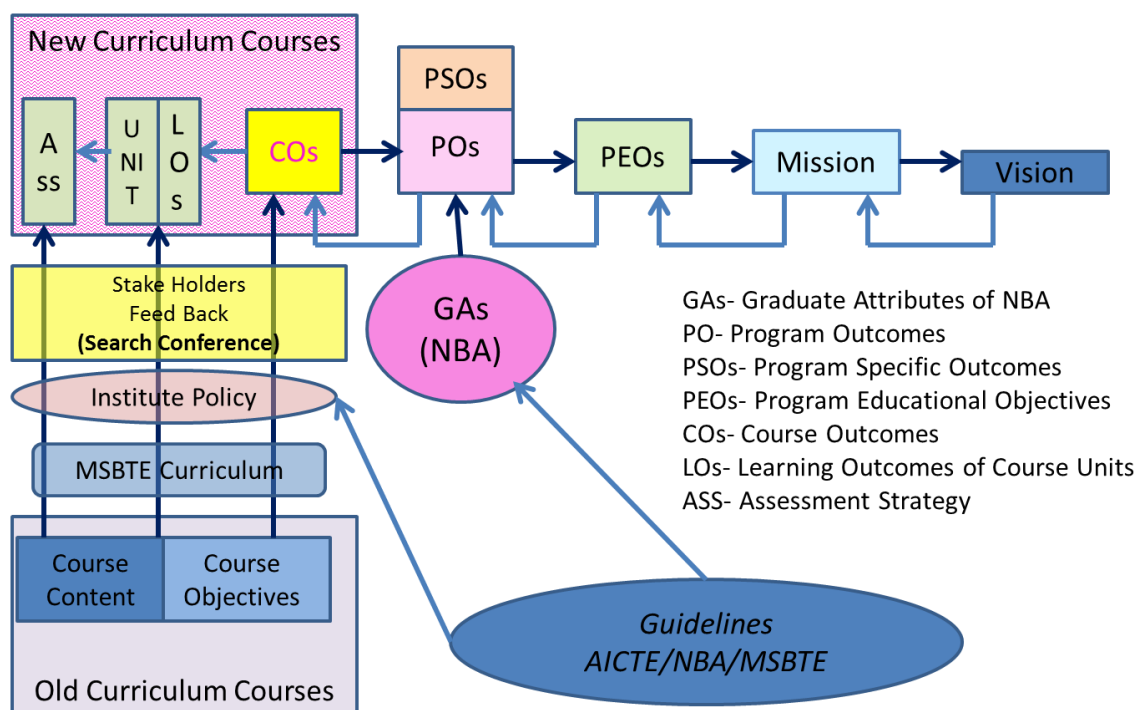


Figure 6.2. GoPoNa Model

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.

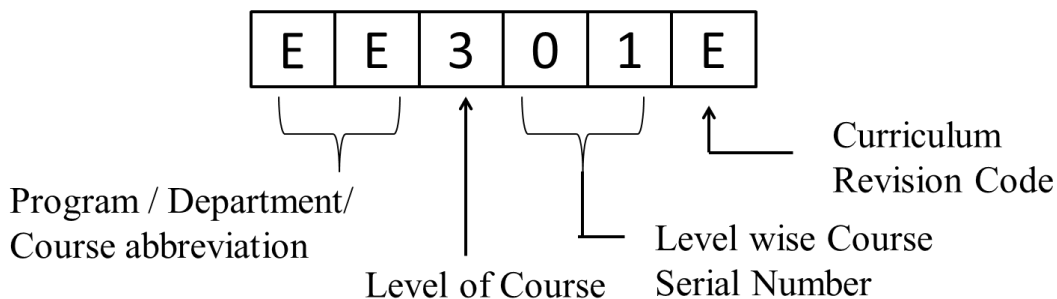


Figure 7.1. Course Code

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 **Electronics and Telecommunication 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 Electronics & Telecommunication Engineering Program:

To thrive for academic excellence through creation of innovative, ethical, emotionally intelligent and globally acceptable professionals in the field of Electronics and Telecommunication Engineering satisfying societal and industrial technological needs.

8.4 Mission of Program

Mission of the Electronics & Telecommunication Engineering Program:

- M1:** To impart high quality electronics and telecommunication engineering education embedded with professional ethics to students.
- M2:** To adopt the best effective instructional methods in order to maximize knowledge transfer.
- M3:** To acquire adequate and innovative processes/system to enhance understanding of implementation of theoretical concepts in practical scenarios.
- M4:** To facilitate the best infrastructure, progressive academic environment to the students and faculty members, creating an ambience, conducive for excellence in electronics and telecommunication engineering education.

8.5 Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of Electronics & Telecommunication Engineering Program are:

- PEO1:** To acquire a fundamental knowledge in engineering and science to improve lives and livelihoods through a successful career in Electronics and Telecommunication Engineering field.
- PEO2:** To develop technical competency to provide solution to the problems in various domain in the field of Electronics and Telecommunication Engineering.
- PEO3:** To attain the skills of professional leadership to deliver effectively in a multi-disciplinary team.
- PEO4:** To attain professional excellence to produce technocrats who ensure professional ethical and moral behaviour to address social, technical and business challenges.
- PEO5:** To engage in lifelong learning and professional development through self study continuing education or professional studies in Electronics and Telecommunication Engineering.

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:** Maintain and operate electronics test and measuring equipments.
- PSO2:** Operate and troubleshoot faults in electronic systems.

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	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	PO 9	PO 10	PSO 1	PSO 2
PEO1	✓	✓	✓	✓	✓				✓	✓	✓	✓
PEO2		✓	✓	✓	✓			✓	✓	✓	✓	✓
PEO3		✓	✓	✓			✓	✓	✓	✓	✓	✓
PEO4		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PEO5		✓	✓	✓		✓	✓	✓		✓		✓

8.9 Identified Skills in Search Conference

8.9.1 Technical skills for Electronics & Telecommunication Engineering

Diploma Students

1. Use electronic test and measuring instruments.
2. Interpret circuit diagrams and specifications of electronic systems given in technical/service manuals for installation, testing and commissioning
3. Devise suitable test set-up for testing of electronic circuits/ equipment
4. Maintain / Troubleshoot microprocessor-based electronic systems.
5. Justify acceptance or rejection of a material, components or equipment
6. Maintain / Troubleshoot electronic equipment.
7. Use test and measuring instruments to test different types of electronic circuits like amplifiers, filters etc.
8. Maintain / Troubleshoot electronic control systems employing micro-controllers
9. Maintain / Troubleshoot power supplies like regulated power supplies, UPS etc.
10. Calibrate and test measuring instruments from standard instruments-traceability.
11. Acceptance test for prototype circuits.
12. Design PCB by preparing PCB layout and artwork.
13. Use quality management systems, TQM and SQC techniques
14. Maintain / Troubleshoot electronic instrumentation systems used in process control
15. Calculate value of the relevant requisite parameters
16. Maintain / Troubleshoot digital communication equipment
17. Maintain / Troubleshoot analog communication equipment.
18. Maintain / Troubleshoot audio electronic equipment.
19. Maintain / Troubleshoot optical fiber communication systems
20. Maintain / Troubleshoot office automation systems like photocopiers, fax machines etc.
21. Maintain / Troubleshoot digital switching systems in telephone/EPABX
22. Maintain / Troubleshoot cellular phones.
23. Maintain / Troubleshoot Personal Digital Assistant (PDA)
24. Maintain / Troubleshoot video cameras and digital still cameras.
25. Maintain / Troubleshoot color television receiver.
26. Understand the working of High Definition TV, Close Circuit TV.
27. Maintain / Troubleshoot radio transmission and reception systems

28. Understand the working of satellite communication systems, PS system.
29. Understand the working of TV transmission systems
30. Understand the working of spread spectrum radio transmission systems & reception
31. Understand the working of RADAR system.
32. Select proper measuring instruments on the basis of range and its least count.
33. Measurement of parameters with instruments .
34. Develop analytical skills for various analysis of chemicals.
35. Handling and operating different machines and tools for preparation of job.
36. Measure and Calculate stress ,strain, identify Beam structure, specify the different forces, mention different trusses
37. Apply network laws and theorems for circuit analysis
38. Use Simulation software for design and verification of electronic system.
39. Use power electronic devices for power control
40. Use Electronic control system for automation.
41. Maintain equipment's in automobile and electrical engg. field. .
42. Assemble computer components, testing of faults, replace fuse, solder components, use internet & other modern communication technique ,

8.9.2 Generic skills for Electronics & Telecommunication Engineering Diploma

Holder

1. Communicate effectively with superiors, subordinates and peers
2. Express ideas in English in written form effectively
3. Express ideas in English in oral form effectively
4. Manage people at work
5. Write reports/proposals and letters of different types
6. Come up with innovative, cost effective ideas & solutions to technical/marketing/personnel problems
7. Critically and logically take decisions based on process flow.
8. Write brief & precise technical reports of observed phenomena
9. Work as a group leader & as a team member to achieve goals Use personal protective
10. Disaster management skill .
11. Enterprise resources planning.
12. Develop and maintain public relations

13. Lead group discussions and meetings independently
14. Use all resources like electronic media, market survey, technical literature etc. to gather information for taking decisions.
15. Ethical relationship attitude development and social responsibility.
16. Effective use of office tools for preparing documents ,worksheet & presentation
17. Effective Use of internet facilities.
18. To prepare reports on various issues related to environmental pollution.
19. To calculate the unknown quantities derive, prove the mathematical expression
20. To develop logical thinking this is useful in comprehending the principles of all other subjects.
21. Drawing, Calculating, Judgment of object.
22. Develop habit of yoga & meditation, maintain physical health, and prepare best from waste.
23. Guide about non-conventional energy resources and energy conservation. , advice about sanitization.
24. Demonstrate the use of internet, provide materials on agriculture technique, try solving their problems, aware them about the new banking technique, reporting writing.

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	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
EN1101	English	X	-	X	-	-	-	-	X	X	X	-	-
EN1102	Communication Skills	X	-	X	-	-	-	-	X	X	X	-	-
IT1101	IT Applications	X	X	X	X	-	-	X	X	X	X	X	X
ME1101	Industrial Organization and	X	-	-	-	X	X	X	-	-	X	-	-

	Management												
EV1101	Environmental Science	X	X	X	-	X	X	X	X	X	X	-	-
EC1101	Soft Skills	-	-	-	-	-	-	X	X	X	X	-	-
PH1201	Engg. Physics	X	-	X	X	-	-	-	X	-	X	-	-
CH1201	Engg. Chemistry	X	-	X	-	-	-	-	X	-	X	-	-
MH1201	Basic Engg. Mathematics	X	-	X	-	-	-	-	X	-	X	-	-
MH1202	Engg. Mathematics	X	-	X	-	-	-	-	X	-	X	-	-
MH1204	Applied Mathematics	X	-	X	-	-	-	-	X	-	X	-	-
WS1302	Workshop Practice	X	-	-	-	-	-	X	X	X	X	-	-
ME1301	Engg. Graphics	X	X	X	X	-	-	X	X	X	X	-	-
CM1307	C Programming	X	X	X	X	-	-	X	X	X	X	X	X
EE1302	Electrical Engg.	X	-	X	X	-	-	X	X	-	X	-	-
EC1301	Test and Measuring Equipments	X	X	X	-	-	X	-	X	-	X	X	X
EC1302	Basic Electronics	X	X	X	X	-	-	-	X	-	X	X	X
EC1303	Circuit Analysis and Simulation	-	X	X	X	-	-	-	X	-	X	X	X
EC1304	Electronic Components	-	X	X	X	-	-	-	X	-	X	X	X
EC1305	Electronic Devices and Circuits	X	X	X	X	-	-	-	X	X	X	X	X
EC1306	Principles of Digital Electronics	-	X	X	X	-	-	-	X	X	X	-	X
EC1307	Principles of Communication Engg.	-	X	X	X	-	-	-	X	X	X	X	X
EC1308	PCB Technology	-	X	X	X	X	-	-	X	-	X	X	X
EC1401	Microprocessor and Microcontroller	-	X	X	X	-	-	-	X	-	X	-	X
EC1402	Communication Systems	-	X	X	X	-	X	-	X	-	X	X	X
EC1403	Linear Integrated Circuits	-	X	X	X	X	-	-	X	X	X	X	-
EC1404	Electronic Workshop	-	X	X	X	X	-	-	X	X	X	X	X
EC1405	Seminar	-	X	-	-	-	-	X	X	X	X	-	-
EC1406	Power Electronics	-	X	X	X	-	-	-	X	-	X	X	X
EC1407	Electronic	-	X	X	X	-	-	-	X	-	X	X	X

	Instrumentation												
EC1408	Audio Video Systems	-	X	X	X	X	-	-	X	-	X	X	X
EC1409	Analog and Digital Electronics	X	X	X	X	X	-	-	X	X	X	X	X
EC1412	Project	X	X	X	X	X	X	X	X	X	X	X	X
EC1501	Embedded Systems	-	X	X	X	-	-	-	X	-	X	X	X
EC1502	Digital Communication	-	X	X	X	-	-	-	X	-	X	X	-
EC1503	Optical Communication	-	X	X	X	-	-	-	X	-	X	X	X
EC1504	Microwave Communication	-	X	X	X	-	X	-	X	X	X	X	X
EC1505	Industrial Electronics	-	X	X	-	-	-	X	X	X	X	X	X
EC1506	Control Systems	-	X	X	-	-	-	X	X	X	X	X	X
EC1507	Mobile Communication	-	X	X	-	-	-	X	X	X	X	X	X
EC1508	Process Instrumentation	-	X	X	X	-	-	-	X	-	X	X	X
EC1509	Testing and Maintenance of Electronic Equipments	-	X	X	X	-	-	-	X	-	X	X	X
EC1510	VHDL Programming	-	X	X	X	-	-	-	X	-	X	X	X
EC1511	Computer Hardware and Networking	-	X	X	X	-	-	-	X	-	X	X	X
EC1512	DOT NET Technology	-	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. Elements of Mechatronics.
2. Computer Communication Network

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

Identified Skills	Courses
G1.Communicate effectively with superiors, subordinates and peers G2.Express ideas in English in written form effectively	1. English
G1.Communicate effectively with superiors, subordinates and peers. G2.Express ideas in English in written form effectively G3.Express ideas in English in oral form effectively . G5.Write reports/proposals and letters of different types	2. Communication skills
G16.Effective use of office tools for preparing documents ,worksheet & presentation. G17.Effective Use of internet facilities..	3. Computer Applications
T13.Use quality management systems, TQM and SQC techniques. G4.Manage people at work. G6.Come up with innovative, cost effective ideas &	4. Industrial Organization and management

solutions to technical/marketing/personnel problems. G7.Critically and logically take decisions based on process flow G9.Work as a group leader & as a team member to achieve goals Use personal protective. G11.Enterprise resources planning. G12.Develop and maintain public relations	
G10.Disaster management skill G15.Ethical relationship attitude development and social responsibility G18.To prepare reports on various issues related to environmental pollution	5. Environmental Science
T10.Calibrate and test measuring instruments from standard instruments-traceability T32 Select proper measuring instruments on the basis of range and its least count.	6. Engineering Physics
T32 Select proper measuring instruments on the basis of range and its least count. T33. Measurement of parameters with instruments . T34. Develop analytical skills for various analysis of chemicals.	7. Applied Chemistry
G19. To calculate the unknown quantities derive, prove the mathematical expression	Engineering Mathematics
G20 To develop logical thinking which is useful in comprehending the principles of all other subjects	Applied Mathematics
G21 Drawing,Calculating,Judgment of object	Engineering Graphics
T35 Handling and operating different machines and tools for preparation of job	Workshop Practice
T36 Measure and Calculate stress ,strain, identify Beam structure, specify the different forces, mention different trusses	Engineering Mechanics
T1 Use electronic test and measuring instruments. T37 Apply network laws and theorems for circuit analysis	Electrical Engineering
T1 . Use electronic test and measuring instruments. T2. Interpret circuit diagrams and specifications of electronic systems given in technical/service manuals for installation, testing and commissioning T3.Devise suitable test set-up for testing of electronic circuits/ equipment. T7.Use test and measuring instruments to test different types	Basic Electronics

of electronic circuits like amplifiers, filters etc. T15.Calculate value of the relevant requisite parameters .	
T1.Use electronic test and measuring instruments . T5. Justify acceptance or rejection of a material, components or equipment.	Electronics Material and Component
T5. Justify acceptance or rejection of a material, components or equipment	Mechanical Technology
T2.Interpret circuit diagrams and specifications of electronic systems given in technical/service manuals for installation, testing and commissioning. T3.Devise suitable test set-up for testing of electronic circuits/ equipment. T11Acceptance test for prototype circuits.	Electronic Devices & Circuits
T3.Devise suitable test set-up for testing of electronic circuits/ equipment T23.Maintain / Troubleshoot Personnal Digital Assistant (PDA)	Principles of Digital Electronics
T18.Maintain / Troubleshoot audio electronic equipment. T27.Maintain / Troubleshoot radio transmission and reception systems	Basics Of Communication
T1 Use electronic test and measuring instruments. T37 Apply network laws and theorems for circuit analysis T3.Devise suitable test set-up for testing of electronic circuits/ equipment. T11Acceptance test for prototype circuits.	Circuit Analysis And Simulation
T4.Maintain / Troubleshoot microprocessor -based electronic systems. T11Acceptance test for prototype circuits. T8.Maintain / Troubleshoot electronic control systems employing micro-controllers T23.Maintain / Troubleshoot Personnal Digital Assistant (PDA)	Microcontroller
T3.Devise suitable test set-up for testing of electronic circuits/ equipment. T11Acceptance test for prototype circuits.	Linear Integrated Circuits
T1.Use electronic test and measuring instruments . T6.Maintain / Troubleshoot electronic equipment. T10. Calibrate and test measuring instruments from standard instruments.	Electronic Instrumentation

T15.Calculate value of the relevant requisite parameters .	
T17.Maintain / Troubleshoot analog communication equipment. T20.Maintain / Troubleshoot office automation systems like photocopiers, fax machines etc. T21.Maintain / Troubleshoot digital switching systems in telephone/EPABX. T28.Understand the working of satellite communication systems,GPS system. T31.Understand the working of RADAR system	Communication Systems
T17.Maintain / Troubleshoot analog communication equipment. T22.Maintain / Troubleshoot cellular phones. T30.Understand the working of spread spectrum radio transmission systems & reception.	Wireless communication
T16.Maintain / Troubleshoot digital communication equipment	Digital Communication
T18.Maintain / Troubleshoot audio electronic equipment. T24.Maintain / Troubleshoot video cameras and digital still cameras. T25.Maintain / Troubleshoot colour television receiver. T26.Understand the working of High Definition TV, Close Circuit TV. T29.Understand the working of TV transmission systems.	Audio Video System
T39 Use power electronic devices for power control. T9.Maintain / Troubleshoot power supplies like regulated power supplies, UPS.	Power Electronic
T40 Use Electronic control system for automation	Elements of Mechatronics
T6.Maintain / Troubleshoot electronic equipment T9.Maintain / Troubleshoot power supplies like regulated power supplies, UPS etc.	Maintenance Of Electronics Equipment's
T12.Design PCB by preparing PCB layout and artwork.	PCB Technology
T3.Devise suitable test set-up for testing of electronic T12.Design PCB by preparing PCB layout and artwork.	Electronic Workshop
T3.Devise suitable test set-up for testing of electronic	Industrial Project

circuits/ equipment . T11Acceptance test for prototype circuits. T12.Design PCB by preparing PCB layout and artwork. G6.Come up with innovative, cost effective ideas & solutions to technical/marketing/personnel problems. G8.Write brief & precise technical reports of observed phenomenon. G9.Work as a group leader & as a team member to achieve goals Use personal protective.	
G6.Come up with innovative, cost effective ideas & solutions to technical/marketing/personnel problems. G8.Write brief & precise technical reports of observed phenomenon. G9.Work as a group leader & as a team member to achieve goals Use personal protective. G11.Enterprise resources planning.	Industrial Practices/ Industrial Training
G3.Express ideas in English in oral form effectively . G6.Come up with innovative, cost effective ideas & solutions to technical/marketing/personnel problems. G8.Write brief & precise technical reports of observed phenomenon. G17.Effective Use of internet facilities.	Seminar
T38 Use Simulation software for design and verification of electronic system	Embedded System
T38 Use Simulation software for design and verification of electronic system	VHDL Programming
T14.Maintain / Troubleshoot electronic instrumentation systems used in process control. T40 Use Electronic control system for automation	Control System
T14.Maintain / Troubleshoot electronic instrumentation systems used in process control. T40 Use Electronic control system for automation	Process Instrumentation
T19.Maintain / Troubleshoot optical fiber communication systems	Optical Communication
T19.Maintain / Troubleshoot optical fiber communication systems	Computer Communication Network
G1 Communicate effectively with superiors, subordinates and peers	Finishing School

T41 Maintain equipment's in automobile and electrical engg. field. T42 Assemble computer components, testing of faults, replace fuse, solder components, use internet & other modern communication technique , G22 Develop habit of yoga & meditation ,maintain physical health, prepare best from waste	Free Electives
G23 Guide about non-conventional energy resources and energy conservation. ,advice about sanitization. G24 Demonstrate the use of internet ,provide materials on agriculture technique, try solve their problems, aware them about the new banking technique, report writing.	Rural Development

8.12 Program Structure

The program structure of the Electronics and Telecommunication 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 ELECTRONICS & TELECOMM. 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 ELECTRONICS & TELECOMM. 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 Application	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	CH202E	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	MH203E	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

DIPLOMA IN ELECTRONICS & TELECOMM. 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	ME302E	Engineering Graphics	Nil	02	00	04	04	00	00	50@	25	75
2	WS301E	Workshop Practice	Nil	00	00	04	02	Nil	Nil	Nil	50	50
3	AM301E	Engineering Mechanics	Nil	03	01	02	05	70	30	50@	25	175
4	EE303E	Electrical Engineering	Nil	04	00	02	05	70	30	50@	25	175
5	EC301E	Basic Electronics	Nil	04	00	02	05	70	30	50@	25	175
6	EC302E	Electronics Materials and Components	Nil	03	00	02	04	70	30	50@	25	175
7	ME305E	Mechanical Technology	Nil	03	00	02	04	70	30	50@	25	175
Total				19	01	18	29	350	150	300	200	1000

8.12.4 Program Structure Level IV: Professional Courses

Table 8.9. Program Structure Level IV: Professional Courses

DIPLOMA IN ELECTRONICS & TELECOMM. 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	EC401E ^{\$}	Electronic Devices & Circuits	EC301E	04	00	02	05	70	30	50#	25	175
2	EC402E	Principles of Digital Electronics	NIL	04	00	02	05	70	30	50#	25	175
3	EC403E	Basics Of Communication	NIL	03	00	02	04	70	30	50@	25	175
4	EC404E	Circuit Analysis And Simulation	NIL	03	00	04	05	70	30	50#	25	175
5	EC405E ^{\$}	Microcontroller	EC402E	04	00	02	05	70	30	50#	25	175
6	EC406E ^{\$}	Linear Integrated Circuits	EC301E	04	00	02	05	70	30	50#	25	175
7	EC407E	Electronic Instrumentation	NIL	03	00	02	04	70	30	50@	25	175
8	EC408E ^{\$}	Communication Systems	EC403E	04	00	02	05	70	30	50#	25	175
9	EC409E ^{\$}	Wireless communication	EC403E	04	00	02	05	70	30	50#	25	175
10	EC410E ^{\$}	Digital Communication	EC403E	04	00	02	05	70	30	50@	25	175
11	EC411E ^{\$}	Audio Video System	EC403E	04	00	02	05	70	30	50@	25	175
12	EC412E	Power Electronics	EC401E	03	00	02	04	70	30	50#	25	175
13	EC413E	Elements of Mechatronics	ME305E	02	00	02	03	70**	30	50@	25	175
14	EC414E	Maintenance Of Electronics Equipment's	EC407E	00	00	04	02	Nil	Nil	50@	25	075
Sub Total (a)				46	00	32	62	910	390	700	350	2350

8.12.5 Program Structure Level IV: Professional Courses (Project Courses)

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

DIPLOMA IN ELECTRONICS & TELECOMM. 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	EC415E	PCB Technology	EC301E	00	00	04	02	Nil	Nil	50 [@]	50	100
16	EC416E ^{\$}	Electronic Workshop	EC415E	00	00	04	02	Nil	Nil	50 [#]	50	100
17	EC417E ^{\$}	Industrial Project	100 CR	00	00	04	02	Nil	Nil	100 [#]	50	150
Sub Total (b)				00	00	12	06	Nil	Nil	200	150	350
c) Seminar and Industrial Training												
18	SE401E	Seminar	60 CR	00	00	02	01	Nil	Nil	50 [@]	50	100
19	ID401E / ID402E	Industrial Training / Industrial Practices	70CR	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)				46	00	48	70	910	390	1000	600	2900

8.12.6 Program Structure Level V: Elective Courses

Table 8.11. Program Structure Level V: Elective Courses

DIPLOMA IN ELECTRONICS & TELECOMM. 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 (Any one from each group)												
Group-A												
1	EC501E ^{\$}	Embedded System	EC405E	04	00	02	05	70	30	50#	25	175
2	EC502E ^{\$}	VHDL Programming	EC402E	04	00	02	05	70	30	50#	25	175
Group-B												
1	EC503E ^{\$}	Control System	EC404E	04	00	02	05	70	30	50#	25	175
2	EC504E ^{\$}	Process Instrumentation	EC407E	04	00	02	05	70	30	50#	25	175
Group-C												
1	EC505E ^{\$}	Optical Communication	EC403E	04	00	02	05	70	30	50#	25	175
2	EC506E ^{\$}	Computer Communication Network	EC403E	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
Sub Total (b)				00	00	04	02	00	00	50	25	75

8.12.7 Program Structure Level V: Elective Courses

Table 8.12. Program Structure Level V: Elective Courses

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	
c) Free Electives Technical (Any one)			% Not offered for Program									
1	FE501E	Basic Building Drawing	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
2	FE 502E	RAC Maintenance	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
3	FE503E	Electrical Maintenance	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
	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)				09	00	14	16	210	90	250	125	675

8.12.8 Program Structure Abstract

Table 8.13. Program Structure Abstract

DIPLOMA IN ELECTRONICS & TELECOMM. ENGINEERING												
Sr. No	Level	Course Title Prerequisite courses/credits	Total 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	05/05	11	01	06	15	280	120	150	75	625
2	II	Basic Science Courses	05/05	16	02	08	22	280	120	150	75	625
3	III	Engineering Sciences and Technical Arts Courses	07/07	19	01	18	29	350	150	300	200	1000
4	IV	Professional Courses	19/20	46	00	48	70	910	390	1000	600	2900
5	V	Elective Courses	5/17	12	00	14	19	210	90	250	125	675
Total			41/54	104	4	94	155	2030	870	1850	1075	5825

Above program structure is approved in PBOS meeting held on 6th April, 2016 for implementation from Academic session 2016-17.

8.13 Award of Class Courses

Table 8.14. Award of Class Courses

DIPLOMA IN ELECTRONICS & TELECOMM. 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	EC401E	Electronic Devices & Circuits	EC301E	04	00	02	05	70	30	50#	25	175
2	EC405E	Microcontroller	EC402E	04	00	02	05	70	30	50#	25	175
3	EC406E	Linear Integrated Circuits	EC301E	04	00	02	05	70	30	50#	25	175
4	EC408E	Communication Systems	EC403E	04	00	02	05	70	30	50#	25	175
5	EC409E	Wireless Communication	EC403E	04	00	02	05	70	30	50#	25	175
6	EC410E	Digital Communication	EC403E	04	00	02	05	70	30	50@	25	175
7	EC411E	Audio video System	EC403E	04	00	02	05	70	30	50@	25	175
8	EC416E	Electronic Workshop	EC415E	00	00	04	02	Nil	Nil	50 [#]	50	100
9	EC417E	Project	100CR	00	00	04	02	Nil	Nil	100 [#]	50	150
10	EC501E	Embedded System	EC405E	04	00	02	05	70	30	50#	25	175
	EC502E	VHDL Programming	EC402E									
11	EC503E	Control System	EC404E	04	00	02	05	70	30	50#	25	175
	EC504E	Process Instrumentation	EC407E									
12	EC505E	Optical Communication	EC403E	04	00	02	05	70	30	50#	25	175
	EC506E	Computer Communication Ne	EC403E									
Total				40	0	28	54	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	54
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	2/11
11	No. of Project Courses	3
12	No. of Seminar Courses	2/3
13	Total Credits (1 Th Hr = 1Credit & 2 Pr Hr = 1Credit)	155
14	Total Marks	5825
15	Proportion of Hours (Periods), Th : Pr	53:47 (approx.)
16	Proportion of Credits, Th : Pr	70:30 (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	2000

8.15 Courses Flow Diagram

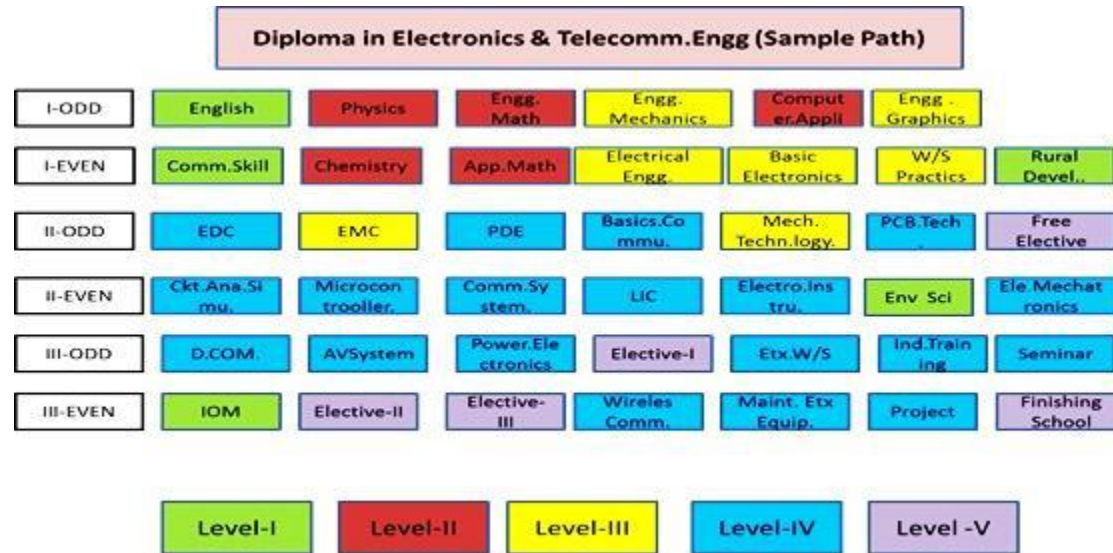


Figure 8.1. Course Flow Diagram (Sample Path)

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 happed 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
	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, Bendar, Macmillan Publication	0333937139
5.	Technical communication principles and practices	Meenakshi Raman, Prakash Singh, Oxford University Press,	0-19-567695-5
6	Effective English Communication	Krishna Mohan, Raman Tata 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.
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(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

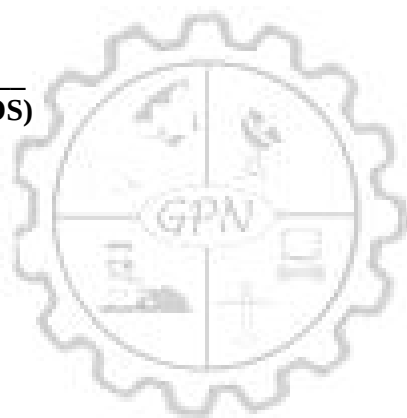
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

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

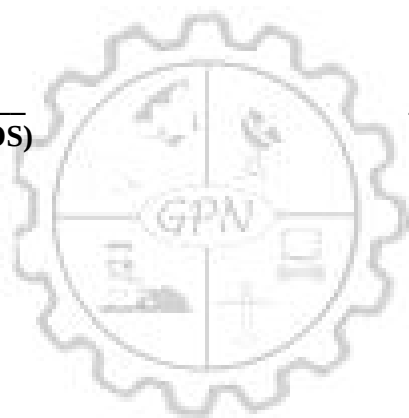
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

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\(y4dqr55g1m1qhnd4soqih45\)\)/pdf/.../January.pdf](http://yojana.gov.in/CMS/(S(y4dqr55g1m1qhnd4soqih45))/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
<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
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/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 EE/EC/IT/CM
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: CH202E
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 EXAM.	: 03 HRs
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: 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 different polymers, insulators or dielectrics, adhesives and their chemical behavior will be useful in their applications in electrical appliances and electronics industries. This will be gateway for development of reasoning capacity of students and understanding new technology as well and capabilities in solving challenging problems at various level of working in the electronic and computer industry.

❖ 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 cells and batteries on the basis of properties and construction.
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. Write 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). Valency: 1.5 Definition & types of valency (Electrovalency & Covalency). 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.	
2. Metallurgy and Alloys	1. Describe the process of extraction of copper and aluminum from its ore. 2. State different properties of copper and aluminum metal. 3. Select proper alloy as per their composition, properties and uses. 4. Write Engineering applications of Al and Cu.	Metallurgy 2.1 Metallurgy of Copper Definitions of metallurgy. 2.2 Extraction process: Ores of copper, extraction of copper from copper pyrite by physical concentration by Froth floatation process and chemical concentration by roasting. 2.3 smelting, bessemerisation, electrolytic refining. 2.4 Engineering Applications of copper. Metallurgy of Aluminum 2.5 Extraction process : ores of Aluminum, extraction of aluminum, purification of bauxite by Hall's process, electrolytic reduction of alumina, 2.6 electrolytic refining of aluminum. 2.7 Engineering applications of aluminum Alloy 2.8 Brass ,Bronze, duralumin, Alnico composition ,properties and applications 2.9 Solders -Composition, properties and applications of ,rose metal and wood's metal	
3. Non-Metallic Engineering	1. Distinguish between thermo softening and thermosetting plastics.	Polymers (Plastics, Rubber) 3.1 Definition of Plastic, Formation of Plastic by Addition & Condensation	

Materials	- List the properties of Rubber. - State the applications of thermal insulators, and Adhesive. - Describe applications of Phenol formaldehyde resin, urea formaldehyde resin and epoxy resin.	- Polymerization, types of polymerization, thermosetting and thermosetting plastic. - Definitions, examples and applications of conducting polymers, photoconductive polymers, electrically insulating polymers, liquid crystal polymer(LCP) Rubber: Types of Rubber. Natural Rubber: Its Processing, Drawbacks of Natural Rubber, Vulcanisation of Rubber with Chemical Reaction. - Synthetic Rubber: Definition, difference between natural and synthetic rubber, - Properties of synthetic rubber such as elasticity, tack, abrasion resistant, their definition and related applications. Insulating material and Adhesives Definition & Characteristics of Thermal insulators. Preparation, Properties & Applications of Thermocole & glasswool. - Definition, characteristics, advantages of adhesive, Properties and application of Phenol formaldehyde resin, urea formaldehyde resin and epoxy resin.	
4. Electro chemistry	- Describe the mechanism of electrolysis. - Identify the role of electrodes in application of electrolysis. - Define terms involved in electrochemistry. - Calculate the problems based on Faradays I, Faradays II law and PH. - Apply the knowledge of electrolysis in Electroplating and Electro refining.	Basic concepts of electrolysis: - Electrolyte, type of electrolyte- strong and weak electrolyte, their difference. - Ionization and electrolytic dissociation, Arrhenius theory of electrolytic dissociation, degree of ionization, factors affecting degree of ionization. - Definitions of electrolytic cell, electrodes- cathode, anode, electrode potential- oxidation potential and Reduction potential. Electrolysis - Mechanism of electrolysis- Electrolysis, electrochemical series for cations and anions. - Mechanism of electrolysis of CuSO_4 solution by using Platinum electrode and Copper electrode. - Applications of electrolysis- Electroplating of Silver, Electro refining of Blister copper. - Faraday's laws of electrolysis: Faraday's First and Second law, relation between electrochemical equivalent and chemical equivalent, numerical. P^{H} and P^{OH}: - Definition of P^{H}, P^{OH}, P^{H} scale, numerical.	

5. Cells and batteries	1. Define basis terms involved in electrochemical cell and battery. 2. Write construction and working of different types of cells. 3. Differentiate Primary and Secondary cells. 4. describe the engineering applications of Lead-acid 5. Storage cell, Ni-Cd Cell, Hydrogen- oxygen fuel cell.	Electrochemical cells/ batteries: 5.1 Basic concepts: Definition of electrolyte, conductivity of electrolytes, cell, battery, electrolytic cell, electrochemical cell, charging, discharging. 5.2 Classification of electrochemical cells: Primary and secondary cells. 5.3 Primary cells: construction, working and applications of - Dry Cell, Daniel cell, 5.4 Secondary cells: construction, working and applications of - Lead-acid storage cell, Ni-Cd Cell 5.5 Fuel cell : Definition, construction, working, advantages, limitations and 5.6 applications of Hydrogen- oxygen fuel cell.	
6. Corrosion	1. Write 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, Types, Atmospheric or Chemical Corrosion, Mechanism, Factors Affecting Atmospheric Corrosion] 6.2 Definition, Types, Atmospheric or Chemical Corrosion, Mechanism, Factors Affecting Atmospheric Corrosion 6.3 Immersed Corrosion or Electrochemical Corrosion, mechanism of electrochemical corrosion absorption of oxygen gas, Evolution of Hydrogen gas. 6.4 Factors Affecting Electrochemical Corrosion, 6.5 Application of Protective Coatings like metal coating by -Galvanizing, Tinning, Sherardizing Metal Spraying, Metal Cladding, Cementation or Diffusion Method. 6.6 Application of non metallic coatings: paint-definition, characteristics, constituents of paint and their functions.	
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	2
2	Determine the percentage of copper in the given brass alloy or copper ore.	Metallurgy and Alloys	2
3	Find the relation between loss in weight of aluminium strip in acidic and alkaline medium and rate of corrosion.	Corrosion	2
4	Determine the strength of given hydrochloric acid solution by titrating it against Sodium hydroxide solution.	Corrosion	2
5	Determine thinner content in oil paint.	Corrosion	2
6	Prepare urea formaldehyde resin used in manufacturing of sun mica Plastic.	Electrochemistry	2
7	Determination of P^H value of given solution by using P^H paper, universal indicator and P^H meter.	Electrochemistry	2
8	Find the Electrochemical equivalent (ECE) of copper.	Cells and Battery	2
9	Perform electro refining process of copper metal.	Electrochemistry	2
10	Prepare Phenol formaldehyde resin used in manufacturing of Bakelite Plastic.	Non-Metallic Engg. Materials	2
11	Analyse basic and Acidic Radicals of known salt solution-1 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
12	Analyse basic and Acidic Radicals of known salt solution-2 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
13	Analyse basic and Acidic Radicals of known salt solution-3 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	2
14	Analyse basic and Acidic Radicals of known salt solution-4 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding	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	
1	Chemical Bonding:	06(04)	04(04)	00(00)	10(08)
2	Metallurgy and Alloys	02(00)	04(06)	06(00)	12(06)
3	Non-Metallic Engineering Materials	06(00)	04(04)	00(00)	10(04)
4	Electrochemistry	02(04)	10(02)	06(04)	18(10)
5	Cells and Battery	02(00)	08(00)	00(06)	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
	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.15 edition	10092
2	Engineering Chemistry	S. S. Dara , S. Chand Publication,15 edition	
3	Engineering Chemistry	R. Sivakumar N. Sivakumar and Tata McGraw-Hill, edition10.	9780745-328896
4	Polytechnic Chemistry	Vedprakash Mehta ,Jain brothers,edition6	13-9788183600134
5	Industrial chemistry	Goel Publication,edition-8	81877224002

❖ **E-REFERENCES:**

http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_polymers-,
assessed on 2 Feb. 2016

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. Digital PH meter

❖ **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 EE/EC/IT/CM
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: MH203E
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, 1PR CREDIT = 2 CLOCK HRs)
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. Determine Mean and R.M.S. values.	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: Mean and R.M.S. values.	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	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,	08

	using differential equations.	exact differential equation. 4.6 Linear and Bernoulli equations.	
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

BLIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Find value of any given function.	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.	Derivatives and Applications of derivative	01
5	Find dy/dx of implicit functions.		01
6	Find dy/dx of parametric functions and 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	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		01
13	Solve D.E. using variable separable method and reducible to variable separable.	Differential equations	01
14	Solve homogenous,linear and Bernoulli D.E.		01
15	Find the approximate root of algebraic equation.	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

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

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. M. Sayyed	I/C HOD, MathsDeptt.	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 EE/EC/CM/IT/MT/TX
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: ME302E
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	: NIL
PR. TEE	: 02 HRs (Internal)
PT. EXAM	: NIL

❖ **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. Draw geometrical figures, curves, sketches etc.
2. Construct the views of an object by using principles of orthographic projection.
3. Visualize three dimensional objects and draw isometric projections.
4. Apply various drawing codes, conventions and symbols as per IS SP-46
5. Interpret various engineering curves
6. Draw free hand sketches of mechanical elements

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Principles of drawing	1. Use of instruments for drawing, scales, lines and their applications. 2. Use of IS SP-46. 3. Loci of points from given data.	1.1 Use of different drawing instruments and equipment 1.2 Types of letters and numbers (single stroke vertical and numbers only) 1.3 Conventions of lines, 1.4 Dimensioning technique as per IS: SP -46 1.5 Scales (reduced, enlarged and full size)- Plain scale, diagonal scale. 1.6 Redrawing 1.7 Loci of points	05
2. Engineering curves.	1. Draw conic sections. 2. Draw involute, cycloid and state their applications 3. Draw helix, spiral from given data.	2.1 To draw an ellipse by- i) Arcs of circles method ii) Concentric circles method 2.2 To draw parabola- I) Rectangle method 2.3 To draw hyperbola by- I) Passing through a given point with reference to given asymptotes 2.4 To draw involutes of circle and polygon of maximum six sides 2.5 To draw cycloid, epi-cycloid and hypo-cycloid	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	07
4. Isometric projections	1. Visualize, interpret and draw Isometric views from given orthographic views	4.1 Isometric scales 4.2 Isometric views of simple object (plane surfaces, slanting surfaces, and Rectangular, V, Trapezoidal slots)	07

5. Free hand sketches	1. Prepare proportionate freehand sketches of given machine elements 2. Describe functions and use of machine element.	5.1 Types of threads profile – Vee and square, acme, buttress, seller, BA threads, knuckle threads. Types of screws 5.2 Bolts – square and hexagonal bolts, eye bolt 5.3 Types of nuts : square, hexagonal, wing 5.4 Foundation bolts: Eye foundation bolt, Rag foundation bolt, Lewis foundation bolt 5.5 Single and double Riveted Lap and Butt joints	05
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 are to be drawn on sketch book only and one problem from each subtopics 1.5 ,1.6 and 1.7 of chapter 1 (01 Sheet)	1.Principles of drawing	12
2	Draw Engineering Curves, one problem from each subtopic of chapter 2. (01 Sheet)	2. Engineering Curves	12
3	Draw two problem using first angle method of projection (01 Sheet)	3 Orthographic Projections	14
4	Draw one problem with plane surfaces & other with slot, slanting surfaces (using natural scale and isometric scale) (01 Sheet)	4. Isometric Projections	14
5	Draw Free Hand Sketches – any ten sketches covering all the topics under chapter 6 (01 Sheet)	5. Free Hand Sketches	12
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 &b Drawing Sheets	4,5,6
		Drawing Portfolio		Continuous	05	--	Drawing Portfolio	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Drawing 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 of scale, redrawing, and loci of point, line work, neatness ,cleanliness and accuracy	10
2	Drawing two Engineering Curves, line work, neatness ,cleanliness and accuracy	10
3	Drawing of orthographic projections , line work neatness ,cleanliness and accuracy	10
4	Drawing of isometric projections, line work neatness ,cleanliness and accuracy	10
5	Drawing of Free Hand Sketches , line work neatness ,cleanliness and accuracy	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	–	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	–	–

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. 2001	81-219-1431-0
6	Engineering Drawing	P. J Shah. 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) Mini-drafter

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. O. V. Sarode	I/C, Head of 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	Er. Ritesh Jain	Deputy Manager	Mahindra and Mahindra Ltd. Nagpur
5	Er. A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6	Mr. 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/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.oin/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 EC, CM, IT
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: EE303E
COURSE TITLE	: 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 EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs (Internal)
PT. EXAM	: 01 HR

❖ RATIONALE:

Knowledge of electrical engineering is essential for the students of Electronics/ Computer/ Information technology. Students should know the facts, concepts, principles and procedures in electrical engineering. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to electrical area. It is very useful course for Solving & understanding the different electronic circuits.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Follow the electrical safety precautions.
2. Solve the electrical circuits by using principle and basic laws.
3. Select transformers and motors for particular applications.
4. Connect electrical measuring instruments in the circuit
5. Use different machines for different application.
6. Operate electrical machines/equipment.

❖ **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.	7
2. Fundamentals of electricity	1. Define the various electrical Parameters, work , power and energy 2. State different effects of electric Current 3. State various law and its applications. 4. Calculate the temperature coefficient of resistance 5. Identify and draw different electrical engineering symbols 6. Describe line diagram of power system 7. Solve series, parallel and series- parallel resistive circuits	2.1 Concept of electric charge, current, voltage drop, EMF, potential difference, Direction of current and their SI units. 2.2 Types of material-conductor, insulator and semiconductor, properties and application. 2.3 Resistance, unit of resistance, Law of resistance (Factors affecting resistance), Effect of temperature on resistance, Ohms law (simple numerical on 2.3). 2.4 Resistance in series, properties of series circuit, voltage distribution in series circuit, equivalent resistance of series circuit, Applications of series circuits, 2.5 Resistance in parallel, properties of parallel circuit, current distribution in parallel circuit, equivalent resistance of parallel circuit, Applications of	9

		parallel circuits, (Numerical problems based on 2.4,2.5) 2.6 Kirchhoff's current and voltage law(no numerical) 2.7 Work, power, energy and their SI units, Relation between H.P and watts, Kwh and Kcal. 2.8 Connection of ammeter, voltmeter and wattmeter in single phase AC circuit. and its measurement. 2.9 Comparison between AC and DC	
3. AC Fundamentals	1. Define terms related to AC fundamentals 2. Compare terms time period and frequency, angular velocity and frequency, frequency and speed. 3. Solve problems related to pure resistive, inductive and capacitive circuit 4. Understand the concept of reactance, Impedance and power factor. 5. State and compare types of electrical loads	3.1 Generation of alternating voltage- single phase and three-phase. 3.2 Equation of sinusoidal alternating voltage and current, important terminology such as- waveform, instantaneous value, cycle, time period, frequency, amplitude, Relation between time period and frequency, angular velocity and frequency, frequency and speed. 3.3 Maximum, average and R.M.S. value of sinusoidal waveform, form factor and peak factor.(No derivation) 3.4 A.C. Voltage applied to pure resistor, pure inductor, and pure capacitor. Concept of reactance, Impedance and power factor, power in single-phase circuits. ((Simple Numerical problem based on 5.4 topic). 3.5 Types of loads.	12
4 Electrostatics & Electromagnetism	1. State Coulombs law of Electrostatics 2. Define terms related to electrostatics 3. Solve series, parallel capacitive circuits 4. Apply laws of electromagnetism	4.1 Coulombs law of Electrostatics, Absolute and relative permittivity, Concept of electric field, electric flux, electric intensity, electric flux density, and electric potential, potential gradient, dielectric strength. 4.2 Capacitance, dielectric constant, capacitance of parallel plate capacitor, capacitance in series and parallel and source of capacitance in electrical systems. Charging &	12

		discharging of capacitor, Dielectric loss. (Numerical problems based on 3.2) 4.3 Types of capacitor and their application 4.4 Faraday's Laws of electromagnetic induction. Direction of induced EMF and current, Lenz's Law, Fleming's right hand rule, Induced EMF, Dynamically induced EMF, statically induced EMF, self-Inductance (L), Mutual Inductance. 4.5 Energy stored in inductor, rise and decay of current through inductor	
5 Transformer	1. State meaning of transformer. 2. Describe the concept of transformation ratio, KVA rating of transformer, voltage regulation and efficiency 3. Classify the different types of transformer	5.1 Definition, principle of operation, types of transformer, 5.2 EMF equation (No derivation), transformation ratio, KVA rating of transformer, voltage regulation and efficiency.(Simple Numerical problem based on 4.2 topic). 5.3 Current Transformer and Potential Transformer- Special features and its applications. 5.4 Auto-transformer –Special features, Schematic diagram and its applications	12
6. Drives	1. Classify different types of AC & DC motors. 2. Select the particular motor for particular application. 3. Describe construction and working of DC machines and AC machines. 4. Understand the need of starter. 5. Control the speed of motor. 6. Describe construction and working of Stepper motor.	6.1 Broad classification of A.C & D.C Drives. 6.2 DC Drives- General working principle of D. C. motor. Types-shunt, series and compound motor. Application and selection for different applications need of starter, 3 point starters, reversal of rotation. 6.3 AC Drives-Single-phase induction motors, their types, application and selection for different applications, reversal of rotation. 6.4 Principle of operation of Stepper Motor and its application. (No Numerical on topic 6)	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify electrical measuring instruments, sources, ICDP/ITDP, switches, loads, wires and execute safety precautions in laboratory.	Electrical Safety	2
2	Connect voltmeter, ammeter and wattmeter in electrical circuit.	Fundamentals of Electricity	2
3	Measure the current, voltage and resistance with the help of multi-meter or tong tester.		2
4	Calculate the unknown resistance in an electric circuit using ohms law.		2
5	Calculate the temperature coefficient of resistance of conductors		2
6	Measure the total resistance of series circuit & parallel circuit		2
7	Find the branch current and mesh voltage using Kirchhoff's laws. (KCL & KVL)		2
8	Use test lamps for testing single-phase and three – phase supply. Use of tester on single-phase supply.		2
9	Test capacitor. Plot charging and discharging curve of capacitor.		Electrostatics& Electromagnetism
10	Measure the inductance of a given coil.	2	
11	Connect voltage & current ratio of single- phase transformer.	Transformer	2
12	Operate CRO and Observe the current & voltage wave form for purely R,L& C ac circuit &interpret the phasor relationship.	AC Fundamentals	2
13	Reverse the directions of rotation of DC shunt motor.	Drives	2
14	Reverse the directions of rotation of single-phase capacitor start motor		2
15	Identify different parts of Stepper motor at fixed angular step.		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)	04(04)	00(00)	06(04)
02	Fundamentals of electricity	02(00)	04(06)	06(00)	12(06)
03	AC Fundamentals	06(04)	10(00)	00(06)	16(10)
04	Electrostatics & Electromagnetism	00(02)	04(04)	06(00)	10(06)
05	Transformer	02(02)	04(04)	06(00)	12(06)
06	Drives	06(04)	08(04)	00(00)	14(04)
	Total	18(12)	34(22)	18 (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	2	R	2	2	R	2	3	R	2	5	R	2	6	R	2	4	R	2	
	5	R	2																
02	3	R	4	1	U	4	2	U	4	1	U	4	4	U	4				
03	3	U	4	4	U	4	5	U	4	3	R	4	5	U	4				
04	6	R	4	6	U	4	6	U	4	6	R	4	6	R	4				
05	3	U	6	2	A	6	3	A	6										
06	4	A	6	5	A	6	2	U	6										

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	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	-	1	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-
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.	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:**

- <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
- www.learnerstv.com/Free-engineering-Video-lectures-ltv059-Page1.htm assessed on 28th Feb 2016
- www.studyaaar.com/index.../11-basic-electrical-a-electronics-engineerin assessed on 28th Feb 2016
- www.faadooengineers.com/.../448-BASIC-ELECTRICAL-ENGINEERIN assessed on 28th Feb 2016.
- <https://www.scribd.com/.../Lecture-Notes-Basic-Electrical-and-Electronic> assessed on 28th Feb 2016

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

1. Meters: Ammeter MI 0-5-10 A, Voltmeter MI 0-150-300, Wattmeter 0-3000 W, Digital Multi-meter, Tong tester, Megger 500V/1000V Hand driven.
2. Rheostat assorted sizes, Variable Inductor, Capacitor
3. Single phase induction motor, 230 V, 50 Hz, 1 kw
4. Single phase transformer, 230/115 V, 50 Hz., 1 KVA
5. CRO, duel trace
6. DC Shunt Motor, 220 V, 3 HP

❖ **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.	Mrs. K. M. Gaidhane	I/C, Head of Electrical Engineering	Government Polytechnic, Nagpur.
3.	Mr. R. I. Kamble	Lecturer in Electrical 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. H, N. Kharkar	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
8.	Mr. N. H. Adkine	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
9.	Mrs. A.P. Gandhi	Lecturer in Electrical Engineering	Government Polytechnic, Nagpur.
10.	Mr. R. Y. Ghormade	HOD, Electrical Engineering	Dharampeth Polytechnic, Nagpur
11.	Mr. B. P. Bale	Dy. Engineer.	MSDCL, Nagpur
12.	Dr. S. S. Bharatkar	Lecturer in Electrical Engineering	Government Polytechnic, Amravati

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG

LEVEL NAME : ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES

COURSE CODE : EC301E

COURSE TITLE : BASIC ELECTRONICS

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:**

Electronics engineering students should know the facts, concepts, principles and fundamental circuits used in all electronic circuits. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to Electronics area. It is very useful course for understanding basic Electronic devices, their ratings and applications

❖ **COURSE OUTCOMES:**

After completing this course students will be able to—

1. Illustrate the construction of Electronics components.
2. Analyze the functioning of Electronic components.
3. Use semiconductor devices in Electronic circuits.
4. Analyze simple Electronic circuits.
5. Use different Equipments / meters for measurement and testing of Electronic circuits.
6. Assemble & test different Electronic circuits.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Semiconductor Theory , P-N Junction Diode& Zener Diode	1. Define terms related to semiconductor. 2. Describe the Formation of PN junction 3. Draw & describe the Forward and reverse V-I characteristic of different diodes 4. Draw the symbols of different types of diodes 5. Compare Zener breakdown and Avalanche breakdown 6. State the Principle of operation of different diodes. 7. State Specification of Diodes. 8. Apply Zener Diode as a voltage Regulator.	1.1 Definition& importance of Electronics. 1.2 Electronics system model(Input process output) 1.3 Units & scales related to Electronics. 1.4 Commonly used semiconductor - Germanium, Silicon. Intrinsic semiconductor, Extrinsic semiconductors. P-type and N-type semiconductors 1.5 PN junction. Formation of PN junction 1.6 Forward and reverse biasing. V-I characteristic of PN junction diode, 1.7 Specification of diode 1.8 Working of various diodes- PIN diodes ,Varactor diodes, Tunnel diodes 1.9 Types of reverse breakdown- Zener and Avalanche breakdown and their comparison 1.10 Principle of operation, characteristics, specifications and applications of Zener diode. 1.11 Specifications –Zener voltage, power dissipation, breakdown current, dynamic resistance & maximum reverse current and applications of Zener diode 1.12 Zener diode as a voltage regulator	16
2.Rectifiers& Filter Circuits	1. Define the terms related to rectifier & filter. 2. Describe circuit diagrams and operation of Rectifiers & Filters. 3. Compare the difference between half and full wave rectifier.	2.1 Definition and types of rectifier. Circuit details, operating principle, advantages and disadvantages of half wave rectifier. 2.2 Circuit details, operating principle, advantages and disadvantages of half wave and full wave rectifiers 2.3 Definition of peak inverse voltage	12

	4. Draw the waveforms of rectifiers & filter circuits	(PIV), ripple factor, form factor, rectification efficiency and transformer utilization factor (TUF) 2.4 Comparison of half and full wave rectifier 2.5 Necessity of filters and types of filter. 2.6 Circuit diagram, operating principle and output waveforms of series inductor, shunt capacitor, chock input (LC), CLC (PI) filter.	
3. Bipolar Junction Transistor	1. Define the terms related to transistor. 2. Identify PNP & NPN transistor. 3. Describe the constructional details of Transistor 4. Describe the operating regions of transistor. 5. List the application of transistor 6. Differentiate CB, CE, CC 7. Analyze the CB, CE, CC circuits.	3.1 Structure of PNP and NPN Bipolar Junction Transistor (BJT) 3.2 Construction, operating principle and symbol of PNP and NPN transistor. 3.3 CB, CE and CC transistor configuration 3.4 Input and output characteristics of transistor in CB and CE configuration 3.5 Definition of transistor parameter- Input resistance, output resistance, current gains alpha and beta. Relation between current gains (Alpha and Beta), leakage currents. 3.6 Application and specifications of transistors-V_{CEsat}, I_{cmax}, V_{CEO}, I_{CEO}, V_{CE} breakdown, power dissipation 3.7 Comparison of CB, CE and CC. 3.8 Advantages of CE configuration	14
4. Transistor Biasing And Stabilization	1. Define Faithful amplification, DC load line & AC load line. 2. Describe Biasing & stabilization 3. Analyze the biasing circuit. 4. Compare biasing circuits.	4.1 Definitions of Faithful amplification. Transistor biasing and Stabilization 4.2 DC load line, AC load line 4.3 Stabilization: Need for bias stabilization 4.4 Methods of transistor biasing circuits & explanation – i) Fixed bias ii) Collector to base bias resistor iii) Base bias with emitter feedback iv) Voltage divider bias	12

5. BJT Amplifier	1. Apply transistor as an amplifier 2. Define the terms-gain, voltage gain ,current gain , power gain, decibel gain , bandwidth 3. Analyze the single stage common emitter amplifier & its Frequency response	5.1 Classification of amplifiers, Single stage BJT amplifier in CE configuration 5.2 Definition of gain, voltage gain ,current gain , power gain, decibel gain , bandwidth 5.3 Frequency response of single stage CE amplifier	04
6. Field Effect Transistor	1. Classify FET 2. Describe the construction of FET 3. Describe the Principle of operation of FET 4. Analyze the drain and transfer characteristics of FET. 5. Relate the terms amplification factor, drain resistance & trans conductance. 6. State advantages, applications and specifications of JFET 7. Compare of BJT and JFET	6.1 Classification of FET. 6.2 Construction, symbol, operating principle and characteristic of P channel and N-channel JFET 6.3 Definition of pinch off voltage, cut of voltage, trans conductance, amplification factors. 6.4 Relation between JFET parameters- amplification factor, drain resistance, trans conductance. 6.5 Advantages, applications and specifications of JFET 6.6 Comparison of BJT and JFET	06
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	i) Set the proper voltage & current limits with controls in regulated power supply. ii) Measure voltage & currents using multimeter.	-	2
2	Use the different front panel controls of CRO for measurement.	-	2
3	Measure V_{pp} & Frequency for different waveforms generated from function generator on CRO.	-	2
4.	Find the relation between voltage and current of PN junction Diode. Plot V-I characteristics of P-N junction diode and find the value of cut-in voltage. Calculate the static and dynamic resistance.	P-N Junction Diode	2
5.	Connect Half-wave rectifier and Full wave center tap rectifier with CRO and draw the input and output waveforms. Find the average DC voltage for each.	Rectifiers & Filter Circuits	4
6.	Measure and compare the ripple voltage from the output waveform of Bridge rectifier without capacitor filter and with capacitor filter.	Rectifiers & Filter Circuits	2
7.	Connect the CLC (π) filter circuit with full-wave centre tap rectifier. Plot the Input Output waveform.	Rectifiers & Filter Circuits	2
8	Find the relationship between voltage and current and plot the V-I characteristics of Zener diode. Measure the Zener breakdown voltage.	Zener Diode	2
9	Plot voltage regulation characteristics of Zener voltage regulator.	Zener Diode	2
10	Connect CE configuration of transistor with multimeters. Measure the Voltage & Current. Plot the Input & output characteristics of transistor in CE configuration	Bipolar Junction Transistor	2
11	Connect FET circuit with multimeters. Measure V_{DS} & I_D . Plot the drain characteristics of JFET Calculate the pinch off voltage.	Field Effect Transistor	4
12	Find the Frequency response of single stage CE amplifier. Measure the bandwidth.	BJT Amplifier	4
Skill Assessment			2
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Semiconductor Theory & P-N Junction Diode & Zener Diode	02(04)	08(04)	06(00)	16(08)
02	Rectifiers & Filter Circuits	02(00)	08(06)	00(00)	10(06)
03	Bipolar Junction Transistor	06(02)	10(04)	00(04)	16(10)
04	Transistor Biasing And Stabilization	02(00)	08(00)	00(06)	10(06)
05	BJT Amplifier	00(02)	04(04)	06(00)	10(06)
06	Field Effect Transistor	02(00)	00(04)	06(00)	08(04)
	Total	14(08)	38(22)	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	6	R	2	3	R	2	5/7
	5	R	2																
02	1	U	4	1	U	4	2	U	4	1	U	4	3	U	4				3/5
03	2	U	4	3	U	4	4	U	4	3	A	4	5	U	4				3/5
04	1	R	4	4	U	4	5	U	4	6	U	4	3	R	4				3/5
05	1	A	6	3	U	6	2	U	6										2/3
06	5	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 circuit diagram, selection of equipment's. writing procedure etc.	20
2	Performance	10
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	-	3
4	3	3	2	2	-	-	-	3	-	3	2	3
5	3	3	2	2	-	-	-	3	-	3	2	3
6	3	3	2	2	-	-	-	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.	Principles of Electronics	V. K. Mehta, S. Chand & Company Ltd., Reprint, 1996	8121910536
2.	Electronic Principles	A.P. Malvino, Tata McGraw Hill, 8 th edition	9780073373881
3.	Applied Electronics	R. S. Sedha, S. Chand & Co, revised edition, 2013	8121927838, 9788121927833
4.	Basic Electronics	Grob, Tata McGraw Hill, 12 th edition	0073510859
5.	Electronics Devices & Circuits	S Salivahanan, Tata McGraw Hill, 2 nd edition 2011	0074633864, 9780074633861

❖ **E-REFERENCES:**

- www.learnelectronicsonline.com , assessed on 4th May 2016
- www.instructables.com/id/Basic-Electronics, assessed on 4th May 2016
- **Learn about-electronics. Org**, assessed on 4th May 2016

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

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. Digital Multi-meter
4. Cathode ray oscilloscope- 0 to 50 MHz
5. Function Generator
6. Regulated Power Supply

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mrs. R. R. Vairagade	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mr. D. A. Brahmanekar	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mrs M. N. Bawane	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
5.	Mr. V. M. Sakode	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
6	Mr. Sandip V Darwhekar	Director	Beta Computronics Pvt Ltd , Nagpur
7	Dr. V. H. Mankar	Lecturer, Electronics Engg.	Government Polytechnic, Brahmapuri.
8	Mrs Gajala Ali	Head of Electronics Engg	Anjuman Polytechnic , Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: EC302E
COURSE TITLE	: ELECTRONICS MATERIAL AND COMPONENT
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. EXAM	: 01 HR

❖ RATIONALE:

The main objective of this course is to impart knowledge of different electronics materials and various components used in electronics industries. This course also describes suitability and characteristics of various electronics components for different applications.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify different electronic components.
2. Find the values of component using colour codes.
3. Describe the operation of different electronics components.
4. Handle basic electronics workshop tools properly and skillfully
5. Measure different parameters using meters.
6. Test different electronics components.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Conductors	1. Classify different conducting materials. 2. Define superconductivity. 3. Compare between soft and hard solders. 4. State meaning of solder. State its types. 5. State meaning of flux. State its uses. 6. Classify the fluxes. 7. Describe the high conductivity materials. 8. State the specifications, properties and applications of different conducting materials. 9. Compare different types of conducting materials.	1.1 Classification of conductors 1.2 Properties and applications of High conductivity materials: Copper, Aluminium, Iron, Silver, Platinum, Nickel, Mercury, Lead, Tin. 1.3 Properties and applications of High resistivity material: Constantan (Eureka), Manganin, Nichrome, Fechrals and chromals. 1.4 Properties and applications of Soft solders and hard solders, Tin-Lead solders and Silver-Palladium solders, Difference between hard and soft solder. 1.5 Fluxes: classification of fluxes, active fluxes, acid free fluxes, corrosion resistance flux- applications. 1.6 Superconductivity: superconductors, transition temperatures, critical temperature – properties, applications of various superconducting materials.	05
2. Dielectric Materials	1. State various terms like dielectric constant K, dielectric losses, breakdown strength. 2. State the requirements of good insulating material. 3. Describe various breakdowns in dielectrics. 4. Describe the various groups of insulating material. 5. Select suitable dielectric materials.	2.1 Properties of insulator. 2.2 Dielectric constant and dielectric losses. 2.3 Electric strength and breakdown strength. 2.4 Types of dielectric materials with examples. 2.5 Breakdown of solid, liquid & gaseous insulating materials. 2.6 Requirement of good insulating material, organic, inorganic, Piezo-electric. 2.7 Dielectrics used in cables & transformer.	05
3. Magnetic materials and Microphones, Speakers	1. Classify magnetic materials and describe it. 2. Compare different types of magnetic materials. 3. Define permeability. 4. Classify the different types of microphones and speakers. 5. Describe various types of microphones and loudspeakers.	3.1 Magnetic materials • Classification of magnetic materials: • Definition of permeability. • Dia, para, ferro & ferri magnetic materials. • Soft and hard magnetic materials. 3.2 Microphones. • General requirements and classifications of microphones.	08

	6. State the use of baffles and enclosures in loudspeaker. 7. Identify types of loudspeakers, microphones. 8. Select loudspeakers and microphones for proper applications.	• Construction and working of Carbon microphone, Condenser microphone, Crystal microphone and ribbon microphones. 3.3 Loudspeakers • Classification of Loudspeakers: • Horn loudspeaker, Exponential loudspeaker and Column loudspeakers. • Roll of baffles and enclosures in loudspeaker.	
4. Passive and Active Components	1. Name the materials used for metal film resistor 2. State the raw material used for making LDR. 3. Draw different IC packages. 4. List the materials used for thermister. State its applications. 5. Identify IC packages. 6. State the testing procedure. 7. List types of active components, passive components. 8. Describe the construction and operation of different resistor, capacitor and inductor. 9. Classify the resistors, capacitor and inductors. 10. Identify resistors, capacitors and inductors. 11. Find value of components using color codes.	4.1 Resistors • Classification of resistors, • Construction of Carbon composition, carbon film, metal film, wire wound & cermet resistors. • Color coding of resistors.(Numerals on color coding) • Construction of LDR, Thermistors, variable resistors, rheostat, potentiometer. 4.2 Capacitor • Classification of capacitor. • Construction of Aluminium, Tantalum electrolytic capacitors, paper, ceramics, glass capacitors. • Variable capacitors- Trimmer capacitors. • Color coding of capacitors. (Numerals on color coding) 4.3 Inductors. • Classification of Inductors , • Color coding of Inductors.(Numerals on color coding) 4.4 Types of packages of diodes, transistor, JFET, and MOSFET. 4.5 IC packages- DIP, PLCC, BGA, and PPFF. 4.6 Identification of ICs & Testing of Components.	08
5. Switches, Relays and Display	1. Classify the different types of switches, relay and display. 2. State applications of relays, LED 3. State the material used for i) Contact ii) Core iii) Yoke of a D.C. relay. 4. Compare between LED and LCD. 5. Describe construction and operation of different switches, relays and display.	5.1 Switches • Classification of switches. • Symbol of SPST, SPDT, and DPDT switches. • Constructional diagram, operation and application of Toggle, rotary, proximity, micro, Membrane, DIP, Thumb wheel, tact switches. 5.2 Fuses and Fuse holders. • Necessity of fuses in electronics devices. • Types of fuses and holders used in electronics devices.	14

	6. State specification of relay. 7. Select Switches, Relays and Display for particular application.	5.3 Relays • Types of relay, relay contacts. • Working principle and constructional diagram of electromagnetic relay, Dry reed relay, Ferried reed relay and Mercury wetted relay. • Specification, application & testing of relays. 5.4 Displays • Classification of displays. • Operation and constructional diagram of LED and LCD displays. • Advantages, disadvantages, Applications of displays. • Constructional diagram and operation of surface mount LED, Color LCD, Fluorescent displays, Liquid vapour display, Segmental and Dot matrix displays.	
6.Cable , Connectors and Photosensitive Devices	1. List the types of wires and its use. 2. State why silver plating is used in RF connectors. 3.State applications of BNC Connector. 4. State the different types of Cables, connectors, 5. Classify the types of sheathed cable. 6. State the factors which are considered while selecting proper insulating material. 7. Describe the construction and operation of Photo diode and Phototransistors. 8. Describe the construction and operation of different cables and connectors. 9. Select wire, Cable and Connectors for particular application.	6.1 Wire • Materials for wire, Types of wires, Use of wire. • Factors of selection of insulating materials, Insulating sleeves. 6.2 Cables • Types of cables. • Operation of coaxial, twin core cables, Twisted & shielded pair cables, R.F. cables, Ribbon cable, High temperature cable, Low impedance cable. • Types of sheathed cables. • Operation of Optical fiber cable. • Characteristics of impedance cable. • Choice for size of cables, Functional Identification of wires by colours. 6.3 Connectors • Types of connectors. • Operation and diagram of Audio, R.F, UHF, BNC, TNC & PCB edge connectors, Jacks, sockets & circular connectors. 6.4 Construction, Operating principle and Specifications of Photo diode, Phototransistors.	08
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Measure the resistance of conductor-.copper, aluminium of given wire and relate them	1.Conductors	2
2	Identify various speakers and measure the value of coil resistance for each.	2. Magnetic Materials and Microphones , Speakers	2
3	Connect speaker to different toness generator and identify it.		2
4	Identify different types of microphones.		2
5	Collect specifications of microphones for different companies.		2
6	Collect specifications of speakers for different companies.		2
7	Measure value of resistor using multimeter. And relate with the value by colour code.	3. Passive and Active Components	2
8	Measure value of capacitor with the help of LCR Q meter.		2
9	i) Test diode for conductivity. ii) Identify the terminals of the transistor with the help of multimeter.		2
10	Identify different IC packages		2
11	Distinguish switches and find out the contact resistance of the switch.	4. Switches, Relays and Displays	2
12	Measure minimum relay current.		2
13	i) Identify different terminals of 7 segment display and display numeral by connecting to the power supply ii)Test the LED for conductivity..		2
14	Test BNC connector for conductivity.	5. Cables , Connectors and Photosensitive Devices	2
15	Connect light source to optical fibre and detect the output.		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	Conductors	00(02)	08(04)	00(00)	08(06)
02	Dielectric Materials	02(04)	04(00)	04(00)	10(04)
03	Magnetic Materials, Microphones and Speakers	04(02)	06(00)	00(04)	10(06)
04	Passive and Active Components	06(00)	06(04)	00(04)	12(08)
05	Switches, Relays and Displays	08(04)	06(06)	04(00)	18(10)
06	Cables, Connectors and Photosensitive Devices	04(00)	04(06)	04(00)	12(06)
	Total	24(12)	34(20)	12(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	2	R	2	4	R	2	5	R	2	6	R	2	6	R	2	1	R	2	5/7
	3	R	2																
02	1	U	4	3	R	4	4	R	4	2	R	4	5	R	4				3/5
03	1	U	4	6	U	4	6	A	4	1	U	4	3	A	4				3/5
04	2	U	4	2	A	4	5	A	4	4	U	4	4	A	4				3/5
05	5	R	6	5	U	6	5	U	6										2/3
06	3	U	6	4	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	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	-	-	-	-	3	-	3	3	3
2	-	3	3	-	-	-	-	3	-	3	-	3
3	-	3	3	-	-	-	-	3	-	3	-	3
4	-	3	3	2	-	-	2	3	-	3	3	3
5	-	3	3	2	-	-	2	3	-	3	3	3
6	-	3	3	2	-	-	2	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.	Electronics Material and Components	Madhuri Joshi	0831131799
2.	Encapsulation of Electronic Devices & Component	Edward R. Salmon	0824775899
3.	Electrical & Electronic Engineering Materials & Components.	S. K. Bhattacharya	1234567147028
4.	Electronic Component & Processes	Preeti Maheshwari	8122417949
5.	Electronic Components & Materials	Joshi	817366900
6.	Electronics Materials and Components	B.G Joshi	-----
7.	Electrical Engineering Materials	Indurkar	-----
8.	Electronics Components and Materials	Dummer	-----

❖ **E-REFERENCES:**

- www.learnelectronicsonline.com
- www.instructables.com/id/Basic-Electronics

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

1. Digital Multi-meter
2. Cathode Ray Oscilloscope
3. Function Generator
4. Soldering Station

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

S.N.	Name	Designation	Institute / Industry
1	Prof. S. S. Tadas	I/C, Head of Electronics Engineering	Government Polytechnic, Nagpur.
2.	Prof. K. P. Yenurkar	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
3.	Mrs. M. N. Bawane	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
4.	Mrs. H. R. Bhusari	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
5.	Prof. D. A. Brahmanekar	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
6.	Prof. R. R. Vairagade	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
7.	Mr. Sandip V Darwhekar	Director	Beta computronics Pvt Ltd , Nagpur
8.	Dr. V. H. Mankar	Lecturer, Electronics Engg.	Government Polytechnic, Brahmapuri.
9.	Mrs Gazzala Ali	Head of Electronics Engg	Anjuman Polytechnic , Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG

LEVEL NAME : ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES

COURSE CODE : ME305E

COURSE TITLE : MECHANICAL TECHNOLOGY

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 (Internal)

PT. : 01 HR

❖ **RATIONALE:**

This course is classified under basic technology courses. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to mechanical engineering, which are commonly used in any discipline of Engineering & Technology. This course introduces basic terminology of oil hydraulics and pneumatics as well as Industrial Robotics with NC/ CNC machine to realize needs of electronics sensor & PLC for automation in Industry.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Select proper mechanical parts/ accessories of machines & IC Engines related to Electronics Engineering.
2. Identify hydraulic and pneumatic components in Industrial automation.
3. Identify manipulator according to its coordinate system and its role in industrial automation.
4. Use proper maintenance tools
5. Assemble & dismantle engine and turbines.
6. Diagnose faults in Hydraulics and Pneumatics systems, engines and prepare technical reports.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1 Maintenance Tools	1. Identify basic mechanical tools. 2. State types of maintenance tools 3. Draw the sketches of tools 4. Describe different maintenance tools. 5. Use cutting tools, hammering tools and maintenance tools.	1.1 Cutting tools- files, drills, chisels, hacksaws- their types, specifications, applications & precautions while handling 1.2 Hammering tools- hammers, mallets- their types, specifications, applications & precautions while handling. 1.3 Maintenance tools- screw drivers, pliers, spanners, wrenches- their types, specifications, applications & precautions while handling.	06
2 Transmission of power	1. Define various power transmitting devices. e.g. shaft, bearing, belts, gears, cam. 2. Compare power transmitting drives. 3. Draw and describe various types of drives 4. Select proper drives for particular application.	2.1 Shafts- Function & its types, Couplings-Function, classification, election of coupling for particular application, Bearings- Function, classification, selection of bearing for particular application 2.2 Cam & Follower-Meaning, Types of Cam & Follower, Terminology. 2.3 Belt drive & Chain Drive – Open and cross belt drive, sleep and creep in belts, comparison between belt and chain drive. 2.4 Gear Drives-Types of Gears, Speed of gear, gear terminology, advantages of gear drive.	08
3 IC Engines	1. State need of IC Engine 2. Classify IC Engine. 3. Describe SI/CI engines, its part and operation with neat sketch 4. Interpret two stroke- four stroke engine and comparison between SI and CI engines	3.1 Internal combustion engine: Necessity, Classification & Fuels used for I.C. Engines. 3.2 Construction, working principle & applications of-- Two stroke & four stroke engines. (Petrol & Diesel) 3.3 Comparison between : i) Two stroke & Four stroke engine, ii) S.I. Engine & C.I. Engine	08

4 Turbines	1. Draw layout of Thermal and hydro power plant. 2. State function of turbine. 3. Classify turbines. 4. Select proper turbine as per head. 5. Compare different turbines.	4.1 Steam turbines- Layout of thermal power plant. Impulse and reaction turbine. 4.2 Hydro turbines- Layout of hydro power plant. Factors to be considered while selecting hydro turbine. 4.3 Pelton, Francis and Kaplan turbine (only figure & working).	08
5 Oil Hydraulics & Pneumatics	1. Draw layout and structure of hydraulic and pneumatic system. 2. Interpret function and symbols of hydraulic and pneumatic components. 3. Describe construction and working of hydraulic and Pneumatic components 4. Select proper actuators 5. Compare various actuators.	5.1 Layout and structure of hydraulic and pneumatic system. Function and symbol of each component. 5.2 Hydraulic components- Gear pump, -Pressure relief valve, and direction control valve. 4/2 DCV- e manually (push button) and electrically solenoid operated. Actuators-Linear –Single Acting and double acting actuators. Rotary actuators- Gear motor and semi rotary- vane type limited rotary motor. 5.3 Pneumatic component-Two stage reciprocating Air compressor, FRL (Filter Regulator and Lubricator) Pneumatic direction control valve (4/2 valve) manually (push button) and electrically solenoid operated. 5.4 Actuators-Linear –Single Acting and double acting actuators. Rotary actuators- vane type air motor.	10
6 Robotics and automation	1. Identify robot anatomy 2. Classify various robot manipulators. 3. Describe various types of automation 4. Draw the block diagram of NC/CNC Machine.	6.1 Introduction, Robot anatomy, classification based on configuration: polar, cylindrical, Cartesian coordinate and spherical. Industrial Applications, 6.2 Automation-Definition, Types- Fixed, Programmable & Flexible automation. 6.3 NC/CNC machines basic elements with simple block diagram.	08
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify various cutting, hammering & maintenance tools.	Maintenance tools	4
2	Use different maintenance tools for maintenance work.		4
3	Select drives for various applications	Transmission of power	4
4	Dismantle and assemble four stroke diesel engines.	IC Engines	4
5	Operate Pelton turbine.	Turbines	4
6	Operate Francis turbine.		4
7	Detect various hydraulics components of mechanical system.	Oil hydraulics & pneumatics	4
8	Detect various pneumatic components of mechanical system.		4
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Maintenance Tools	04(02)	08(04)	00(00)	12(06)
02	Transmission of Power	04(00)	08(06)	00(00)	12(06)
03	IC Engines	04(00)	08(04)	00(06)	12(10)
04	Turbines	02(00)	04(04)	06(00)	12(06)
05	Hydraulics & Pneumatics	06(04)	00(02)	06(00)	12(06)
06	Robotics & automation	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	Drawing diagrams of tools, fasteners, drives, pumps, IC engines and turbines, 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	–
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 & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	A Course in Thermal Engineering	S. Domkundwar., C. P. Kothandaraman and A. V. Domkundwar, Published by Dhanpat Rai & Co. 2004	13: 9788177000214
2.	Oil Hydraulics system: Principles & Maintenance	S.R. Mujumdar, Tata McGraw Hill Publishing Co. New Delhi, 13 th Reprint 2006	0-07-463748-7
3.	Pneumatics system: Principles & Maintenance	S.R. Mujumdar, Tata McGraw Hill Publishing Co. New Delhi, 13 th Reprint 2006	0074602314
4.	Industrial Robotics: Technology , Programming & application	M.P. Groover. Tata McGraw Hill Publishing Co. New Delhi,	0-07-463748-7
5.	CAD/CAM: Computer –Aided Design & Manufacturing.	M. Groover E. Zimmers Pearson Education, 1983	9780132440813
6.	Elements of Workshop Technology (Volume - 1)	S. K. Hajra Choudhury , Nirjhar Roy , A. K. Hajra Choudhury. Media Promoters	13, 9788185099149

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=BaEHVpKc-1Q> , assessed on 29th March, 2016
- https://www.youtube.com/watch?v=qbyL--6q7_4 , assessed on 29th March, 2016
- <http://hillagric.ac.in/edu/coa/agengg/lecture/243/Lecture%203%20Engine.pdf> , assessed on 29th March, 2016

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

- Two stroke and four stroke petrol engine
- Two stroke and four stroke diesel engine
- Pelton wheel/Francis Turbine.
- Centrifugal pump and reciprocating pump.
- Hydraulic and Pneumatic Trainer

❖ **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.	Mr. P.P.Patil	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3.	Mr. A.V. Abhyankar.	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)

LEVEL - IV

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC401E ^{\$}
COURSE TITLE	: ELECTRONIC DEVICES AND CIRCUITS
PREREQUISITE	: EC301E
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 (External)
PT. EXAM	: 01 HR

❖ RATIONALE:

This course deals with applied Electronic circuits and their functions. These circuits are used as functional blocks in complex systems like analogue and digital applications for signal generation & processing. It intends to teach the operating principle and application of electronic circuits like amplifiers, regulators, and time base generators oscillators.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Modify different electronic circuits for various applications
2. Select an electronic circuit based on their characteristics.
3. Analyze different electronic circuits
4. Build different electronic circuits to verify their working
5. Plot waveforms for various electronic circuits like oscillators, multi-vibrators etc.
6. Interpret the characteristics and waveforms of electronic circuits

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Wave shaping circuits	1. Draw circuit of different wave shaping circuits 2. Plot waveforms of different wave shaping circuits 3. Compare different types of wave shaping circuits with respect to the parameters and applications 4. Identify the types of clippers and clampers from their circuits. 5. Describe the working of different wave shaping circuits 6. Modify the circuit of clipper and clamper for different applications	1.1 Necessity of wave shaping, Linear and non-linear wave shaping 1.2 RC differentiator, working, its response to sine and square wave 1.3 RC Integrator , working, its response to sine and square wave 1.4 Operating principle and waveforms of clipping circuits using diode. series & shunt , positive & negative, biased & unbiased , combinational clipper, slicer 1.5 Circuit details, operating principle & waveforms of positive and negative diode clamping circuits 1.6 Applications of clamping circuit- Working of voltage doublers, voltage Tripler circuits	08
2. Regulated power supply	1. State the necessity of regulated power supply 2. Define the terms Voltage regulation, line regulation and load regulation. 3. Describe the working of different regulator circuits. 4. Draw the circuits for regulators. 5. State the principle of SMPS. 6. Compare series and shunt regulators	2.1 Necessity of regulated power supply. 2.2 Block diagram of DC regulated power supply and function of each block 2.3 Definition of Line regulation and Load regulation. 2.4 Operating principle and limitations of Zener diode shunt regulator. 2.5 Circuit details, operating principle, advantages, disadvantages, limitations & Comparison of transistorized series and shunt voltage regulators. 2.6 Circuits detail and operating principle of short-circuit protection circuit in series voltage regulator 2.7 Block diagram & working principle of SMPS. Merits & demerits of SMPS over conventional regulators.	08
3. MOSFET	1. Draw construction of MOSFETs. 2. Plot characteristics of MOSFETs. 3. Compare JFET and MOSFET. 4. State the applications of MOSFET.	3.1 Construction, symbols, operating principle and characteristics of depletion type and enhancement type MOSFET. 3.2 Application of MOSFET as switch 3.3 Comparison of JFET and MOSFET. 3.4 Handling precautions of MOSFET.	06

4. BJT amplifiers	1. Define various terms related to power amplifiers and tuned amplifiers. 2. Describe the working of RC, TC and DC amplifiers. 3. State applications of different amplifiers. 4. Plot frequency response of various amplifiers. 5. Compare voltage and power amplifiers. 6. Compare different multistage amplifiers. 7. Describe working of different power and tuned amplifiers. 8. Analyze the working of power amplifiers.	Multistage Amplifiers 4.1 Need of Multistage Amplifiers, Gain of amplifier. 4.2 Circuit diagram, operating principle, frequency response, advantages, disadvantages and applications of two stage: Resistance-capacitance (RC) coupled, Transformer coupled(TC) and Direct coupled amplifier(DC). 4.3 Comparison of RC, TC and DC coupled amplifiers Power amplifiers 4.4 Comparison of voltage and power amplifiers. 4.5 Concepts of collector efficiency, distortion and power dissipation capability. 4.6 Circuit diagram, operating principle, characteristic features, advantages, disadvantages and applications of Class A, Class B, Class B push pull amplifiers, Complementary symmetry class B push pull amplifiers. 4.7 Characteristics of class C amplifier. 4.8 Thermal runaway and heat sinks (No mathematical analysis) Tuned Amplifiers 4.9 Necessity of tuned amplifier. 4.10 Basic tuned circuits, series & parallel resonance in tuned circuits. 4.11 Resonant frequency, resonance curve, band width and selectivity of parallel resonant circuit.. 4.12 Circuit diagram, working & frequency response of single tuned, double Tuned & stagger tuned circuits	16
5. Feedback amplifiers and Oscillators	1. Draw block diagram of feedback amplifier/ different feedback connections. 2. State Types of different Feedback connections. 3. Draw Transistorized circuits for different negative feedback. 4. Compare different feedback connections 5. State Barkhausen's criterion for oscillations	Feedback amplifiers 5.1 Block diagram and principle of feedback. Types of feedback. 5.2 Types of negative feedback connections – voltage shunt, voltage series, current shunt & current series. Their comparison. 5.3 Advantages, disadvantages of positive and negative feedback in amplifiers. 5.4 Comparison of positive and negative feedback in amplifiers.	14

	6. Classify the oscillators. 7. Draw the circuit of various oscillators. 8. State the operating principle of different oscillators. 9. Analyze the working of different oscillators.. 10. Calculate frequency of oscillation for different oscillators.	5.5 Transistorized circuits for different negative feedback connections Oscillators 5.6 LC tank circuit. 5.7 Barkhausen criterion. 5.8 Classification of Oscillators 5.9 Concept , working and applications of Hartley oscillator, Colpitts oscillator Phase shift oscillators , Wein Bridge oscillators, Crystal oscillator 5.10 Applications of RC, LC and crystal oscillators.	
6 . Multivibrators and Time Base Generators	1. Describe the working of multivibrators/sweep circuits. 2. Compare Astable, Monostable and Bistable multivibrators. 3. State the working principle of different multivibrators. 4. State the necessity of time base signal. 5. Calculate frequency and time period for astable multivibrator. 6. Analyze the waveforms of multivibrators	Multivibrators 6.1 Circuit details, operating principle, waveforms & Applications of Astable, Monostable, Bistable multivibrator. Schmitt trigger circuit , Upper threshold point (UTP) and Lower Threshold point (LTP). 6.2 Comparison of Astable, Monostable and Bistable multivibrators Time Base Generators 6.3 Necessity & features of time base Signal, errors in sweep generator, different methods of generating a time base signal- exponential sweep circuit. 6.4 Working principle of UJT as time Base generators, (Relaxation oscillator). 6.5 Circuit diagram and working of Voltage time base circuit, Miller integrator, Bootstrap sweep circuit, Current time base circuit.	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Assemble/build positive and negative clipper circuit and connect with CRO and observe. Draw the input and output waveforms.	Wave shaping circuits	4
2	Assemble/build positive and negative clamper circuit and connect with CRO and observe. Draw the waveforms.		2
3	Assemble/build differentiator/ integrator circuit and connect with CRO and observe. Sketch waveforms for sine wave input.		4
4	Plot line regulation / load regulation characteristics of Transistorized series/ shunt regulator	Regulated power supply	2
5	Find bandwidth of two stages RC coupled amplifier by plotting frequency response.	BJT amplifier	2
6	Connect the circuit of class A power Amplifier with resistive load to CRO and calculate its efficiency.		2
7	Connect Wein Bridge Oscillator/ Colpitts oscillator/Hartley Oscillator circuit to CRO and measure time period for different values of resistors/capacitors.	Feedback amplifiers and Oscillators	4
8	Measure the time period of oscillations. plot waveforms at base and collector of transistorized astable multivibrator or Measure the voltages at base and collector of transistor to verify the operation of Bistable multivibrator	Multivibrators and Time Base Generators	4
9	Assemble Schmitt trigger circuit and locate UTP and LTP on the graph.		2
10	Connect Miller integrator /Bootstrap sweep generator/ UJT relaxation oscillator to CRO and measure sweep time		4
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	Wave shaping circuits	02(06)	04(00)	04(00)	10(06)
02	Regulated power supply	04(00)	04(04)	00(00)	08(04)
03	MOSFET	00(02)	04(00)	00(00)	04(02)
04	BJT amplifiers	06(04)	12(06)	00(00)	18(10)
05	Feedback amplifiers and Oscillators	06(00)	04(06)	06(04)	16(10)
06	Multivibrators and Time Base Generators	02(00)	06(00)	06(08)	14(08)
	Total	20(12)	34(16)	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	4	R	2	4	U	2	5	R	2	6	R	2	1	R	2	5/7
	3	R	2																
02	2	U	4	3	U	4	4	R	4	1	R	4	2	U	4				3/5
03	1	A	4	4	U	4	5	U	4	4	R	4	6	A	4				3/5
04	1	U	4	2	R	4	5	R	4	5	A	4	6	A	4				3/5
05	4	U	6	6	U	6	5	U	6										2/3
06	5	A	6	6	A	6	4	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 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	2	2	-	-	-	3	-	3	3	3
2	-	3	-	-	-	-	-	-	-	3	3	3
3	-	3	-	-	-	-	-	-	-	3	3	-
4	-	3	-	-	-	-	-	3	-	3	3	3
5	-	3	2	2	-	-	-	3	-	3	3	3
6	-	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.	A Textbook of Applied Electronics	R. S. Sedha , S. Chand and Co. Ltd., Reprint, 2014	8121927838, 9788121927833
2.	Principles Of Electronic Devices & Circuits	A. K. Theraja, B. L. Theraja, R. S. Sedha S. Chand and Co. Ltd., Reprint, 2005	10: 8121921996 13: 9788121921992
3.	Electronics Devices & Circuits	S. Salivahanan , Tata McGraw Hill Education. Reprint 2012	9781259006418
4.	Electronics Devices & Circuits	Allen Mottershed , Tata McGraw Hill, 1984	9788120301245
5.	Pulse, Digital And Switching Waveforms	Jacob Millman, H. Taub, Tata McGraw Hill Education, First Reprint 2011	10: 0-07-107272-113: 978-0-07-107272-4

❖ **E-REFERENCES:**

- <http://www.nptel.ac.in/courses/117101106/10>, assessed on 16th August 2016
- <http://www.nptel.ac.in/courses/117101106/23> assessed on 30th August 2016
- https://www.youtube.com/watch?v=3l_9NEh4Nz8, assessed on 30th August 2016

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

1. Digital Multi-meter 3.5 digit with R, V, I measurements, diode and BJT testing
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based
Bandwidth 20 MHz/30 Mhz
3. Function Generator 1 MHz, sine, square, triangular, ramp and pulse generator Freq range 0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
4. Regulated Power Supply 0- 30 Volt, 2 A with digital display

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S.S. Tadas	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mr. A.A. Ali	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mrs M. N.Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mrs R. R.Vairagade	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5.	Mr.Sandip V Darwhekar	Director	Beta computronics Pvt Ltd , Nagpur
6.	Mrs Gajala Ali	Head of Electronics Engg	Anjuman Polytechnic , Nagpur
7.	Mr. S. M. Kale	Lecturer, Electronics Engg.	Government Polytechnic, Gadchiroli.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC402E

COURSE TITLE : PRINCIPLES OF DIGITAL ELECTRONICS

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 (External)

PT. : 01 HR

❖ **RATIONALE:**

Digital Electronics plays important role in advancements of microelectronics design, manufacturing, computer technology and information systems that have caused the rapid increase in the use of digital circuits. Hence in every application digital technique is the backbone. Digital electronics requires the background of discrete signaling and logical functions, semiconductor switch theory. Hence this subject is introduced for students to sharpen their skills of digital implementation by learning the concept of number systems, logic gates, combinational and sequential logic circuits, memory, counter and shift register.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Identify different ICs of logic gates, combinational and sequential circuits and memories.
2. Realize combinational and sequential circuits.
3. Develop logic circuit for Boolean equation
4. Design digital circuits.
5. Assemble different digital circuits
6. Test and debug the digital circuits and ICs.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Number System	1. Convert from one Number system to another. 2. Perform simple Binary arithmetic operations. 3. Compare analog and digital systems 4. State rules of BCD addition & subtraction 5. Perform BCD addition & subtraction	1.1 Introduction to digital signal, Advantages of Digital System over analog systems, 1.2 Number Systems: Different types of number systems- Binary, Octal, Hexadecimal, conversion of number from one system to another system. 1.3 Binary arithmetic: Addition, Subtraction, Multiplication, Division. Rules and numerical on it. 1.4 Subtraction using 1's complement and 2's complement 1.5 Codes -BCD, Gray Code, Excess-3, ASCII code, definition, conversion 1.6 BCD addition, BCD subtraction using 9's and 10' complement, Rules and numerical on it.	08
2 Logic Gates and Introduction to Logic Families	1. Draw the symbol for various logic gates. 2. Verify the truth table for various logic gates and combinational circuits. 3. Define Logic gates & characteristics of logic families. 4. Develop logic circuit for Boolean equation up to three variables 5. Compare logic families on the basis of characteristics.	2.1 Logic gates: Basic gates and Derived Gates, NAND and NOR as Universal gates. 2.2 Boolean Algebra: Fundamentals of Boolean laws. 2.3 Duality Theorem, De Morgan's theorems. Numerical based on simplification of logic equations. 2.4 Logic Families: Characteristics of logic families & Comparison between different logic families. 2.5 Logic families such as TTL, CMOS, ECL. TTL NAND gate – Totem pole output, open collector. 2.6 CMOS Inverter	10
3 Combinational Logic Circuits	1. State the meaning of SOP and POS 2. Define Minterm and	3.1 Standard representation of canonical forms (SOP & POS), Maxterm & Minterm),	14

	Maxterm - List rules for K-map reduction technique - Implement digital circuits using logic gates by k-map. - Design Half adder and full adder - Design Half subtractor and full subtractor - Design code converter using K-map. - Describe the working and Multiplexer and demultiplexer - Design Boolean expression using Multiplexer and demultiplexer - Implement higher order Multiplexer and demultiplexer tree using lower order Multiplexer and demultiplexer.	conversion between SOP and POS forms. - K-map reduction technique upto 4 variables.(SOP & POS form), - Design of half and full Adder, half and Full Subtractor using K-map. - Code Converter using K-map: Gray to Binary, Binary to Gray Code Converter (up to 4-bit), - IC 7447 as BCD to 7 segment decoder – driver IC 7483 as Adder & Subtractor, 1 digit BCD adder. - Block Schematic of ALU IC 74181 and IC 74381. (Numerical based on above topic). - Multiplexers(MUX): Block diagram, truth table, logic expression and logic diagram of 2:1,4:1,8:1MUX,MUX tree Study of IC 74150, IC 74151,74153 - Demultiplexers (DEMUX): Block diagram, truth table, logic expression and logic diagram of 1:2,1:4,1:8DEMUXDemux tree, Demux as decoder - Study of IC 74138, IC 74139,74155 (Numerical based on above topic)Priority Encoder 8:3, Decimal to BCD Encoder Tristate logic, Unidirectional & bidirectional buffer ICs: IC 74244 and IC 74245	
4 Sequential Logic Circuit	- Compare Combinational & Sequential circuits - Describe working of RS latch – using NAND & NOR. - List and compare different Triggering Methods - Distinguish various Flip flops, counters and shift registers. - Implement asynchronous counter. - Design counter using IC	Sequential circuits: - Comparison between Combinational & Sequential circuits, One bit memory cell - RS latch – using NAND & NOR. Difference between Latch and flipflop. - Triggering Methods (Edge and level trigger) . - Flip Flops - S R Flip flop, Clocked SR flip flop with preset and clear, Drawbacks of SR Flip flop Clocked JK Flip flop with preset & clear, Race	18

	7490.	around condition in JK flip flop, Master slave JK flip flop. D and T type flip flop. 4.4 Excitation table of flip flops. 4.5 Block schematic and function table of IC-7474, 7475, 74373 Shift Register: 4.6 Logic diagram, Truth Table and waveforms of : 4-bit Shift registers (SISO, SIPO, PISO, PIPO) 4.7 4 Bit Universal Shift registers. 4.8 Applications of Shift Register 4.9 (Logic Diagram with waveforms) of: Ring counter, twisted ring counter. Study of Counters : 4.10 Counter: Modulus of counter, their types as Asynchronous and Synchronous counter. 4.11 Asynchronous counter: (Ripple counter, 4 bit up/down Counter) 4.12 Synchronous counter: Excitation table of flip flops, implementation of 3 bit synchronous counter, its truth table and waveforms. 4.13 Block schematic and waveform, IC 7490 as MOD-N Counter	
5 Data Convertors	1. List different types of ADC and DAC 2. Compare weighted and R-2R ADC 3. Describe operation of different DAC and ADC. 4. Use of IC 0800, 0809 in practical applications. 5. Calculate resolution, full scale output voltage of DAC. 6. Calculate conversion time of ADC.	5.1 Introduction and Necessity of Code Convertors. 5.2 DAC Types and comparison of Weighted resistor method, (Mathematical derivation) and R-2R Method (Mathematical derivation up to 3 variable), IC0808 5.3 ADC Types and their comparison 5.4 Block Diagram and working of following ADCs: Single slope ADC, Dual slope ADC, SAR ADC, IC0809	10
6 Memories	1. State significance of memory 2. Classify memories according to types. 3. Compare Volatile and Non-Volatile memory.	6.1 Principle of operation and classification of memory. 6.2 Concept of memory, internal organization of memory, significance of data, address, read and write signal.	04

	4. Describe operation of diode matrix ROM 5. Describe operation of static RAM and Dynamic RAM	6.3 RAM (Static, Dynamic), Volatile and Non-Volatile ROM and its types: PROM, EPROM, EEPROM. 6.4 8*8 array of diode matrix ROM 6.5 Flash memory. 6.6 Comparison between EPROM and Flash 6.7 Study of memory ICs: Identification of IC number and their function: IC 2716, IC 7481 & IC 6116.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs
1	Identify different pins of logic gate IC, apply input, measure output and relate it with the truth table.	Logic Gates & Boolean Algebra	02
2	Assemble various basic gates using universal gates and relate it with the truth table.		02
3	Assemble the logic circuit using AND/OR/NOT logic gates and NAND gates for verification of Boolean expression.		02
4	Assemble the logic circuit using AND/OR/NOT logic gates and NAND gates for verification of De Morgan's Theorem		04
5	Identify different pins of 8:1 multiplexer IC, apply input, measure output and relate it with the truth table.	Multiplexers And Demultiplexers	02
6	Identify different pins of 1: 8 de multiplexer IC, apply input, measure output and relate it with the truth table.		02
7	Assemble the logic circuit for half adder and full adder using logic gates and verify its truth table.	Combinational Circuits	02
8	Identify different pins of J K flip flop IC, apply input, measure output and relate it with the truth table.	Sequential Circuit	04
9	Identify different pins of D/T flip flop IC, apply input, measure output and relate it with the truth table.		02
10	Assemble 4 bit synchronous counter using Flip Flop, show its output on LED and relate it with the truth table.	Counters & Shift Registers	02
11	Assemble decade counter using IC 7490, show its output on LED and relate it with the truth table.		04
12	Assemble 4 bit SISO/PIPO register using flip flop, show its output on LED and relate it with the truth table.		02
Skill Assessment			02
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Number System	06(04)	04(04)	00(00)	10(08)
02	Logic gates and introduction to logic families	04(04)	06(00)	00(00)	10(04)
03	Combinational Logic Circuits	08(00)	04(04)	04(06)	16(10)
04	Sequential Logic Circuit	06(04)	10(00)	04(06)	20(10)
05	Data Convertors	00(00)	06(06)	04(00)	10(06)
06	Memories	00(00)	04(02)	00(00)	04(02)
	Total	24(12)	34(16)	12(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	2	R	2	3	R	2	4	R	2	5	U	2	5/7
	6	U	2																
02	1	R	4	3	A	4	4	A	4	2	R	4	1	U	4				3/5
03	1	U	4	3	U	4	4	U	4	1	U	4	3	U	4				3/5
04	4	U	4	5	A	4	6	U	4	4	R	4	5	U	4				3/5
05	3	R	6	5	U	6	4	A	6										2/3
06	2	U	6	4	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
		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	-	3	-	3
2	-	3	-	-	-	-		3	-	3	-	3
3	-	3	-	-	-	-		3	-	3	1	3
4	-	3	2	2	-	-		3	-	3	-	3
5	-	3	2	2	-	-		3	-	3	-	3
6	-	3	2	2	-	-		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.	Digital Integrated Electronics	Herbert Taub (Author), Donald L. Schilling, McGraw-Hill Inc, 1977	10: 0070857881 13: 9780070857889
2.	Digital Principles and Application	Malvino, Albert Paul; Leach, Donald P., McGraw-Hill, 1986	10: 0070398836 13: 9780070398832
3.	Modern Digital Electronics	R.P.Jain, McGraw Hill Education (India) Private Limited, 2009	10: 0070669112 13: 9780070669116
4.	CMOS/TTL A user's guide with projects	Joseph J. Carr, TAB Books, 1 st Edition, 1984	10: 0830616500 13: 9780830616503

❖ **E-REFERENCES:**

- www.electrical4u.com/digital-electronics , assessed on 20th January 2016
- <http://nptel.ac.in/courses/108108076/1> , assessed on 20th January 2016
- <http://www.electrical4u.com> , assessed on 20th January 2016
- <https://www.youtube.com/watch?v=A9KSGAnjo2U>, assessed on 20th January 2016

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

1. Digital Multi-Meter.
2. Logic Gates ICs (7400,7402,7404,7408,7432,7486)
3. Multiplexer and De multiplexer IC(74150,74151,74138,74139)
4. Flip Flops ICs (7472,7474,74H71,74L71)
5. Breadboard and LEDs.
6. Power Supply

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

S.N.	Name	Designation	Institute / Industry
1.	Mr.S.S. Tadas	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mr.A.A.Ali	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
3	Mrs. M.N. Bawane	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
4.	Mrs. H.R.Bhusari	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur
5.	Ms.K.P.Yenurkar	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur
6.	Mr.V.M.Sakode	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur
7.	Mr. Sandip V Darwhekar	Director	Beta computronicspvt ltd , Nagpur
8.	Mrs. Gajala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
9.	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 ELECTRONICS & TELECOMM ENGG
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC403E
COURSE TITLE	: BASICS OF COMMUNICATION
PREREQUISITE	: NIL
TEACHING SCHEME	: TH:03; TU:00;PR:02(CLOCK HRs.)
TOTAL CREDITS	: 04(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:

Electronics and Telecommunication Engineering students should know the facts, concepts, principles and procedures in communication Engineering. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to Communication area in Electronics Engineering. It is very useful course for understanding the fundamental level knowledge in the field of communication Engineering.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply principle of Electronics and telecommunication engineering for different applications
2. Identify different section in Radio transmission and reception
3. Analyze different parameter of transmission line and their radiation pattern
4. Connect modulation and demodulation circuits
5. Measure different parameter of transmission line and antenna.
6. Troubleshoot AM / FM radio receivers

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Communication fundamentals	1. Define the terms related to communication 2. Describe the functioning of communication system 3. Analyze the Electromagnetic spectrum 4. Apply Electronic communication technique. 5. Classify the different types of Noise	1.1 Introduction to communication and elements of communication systems 1.2 Block diagram of communication system and function of each block. 1.3 Electromagnetic spectrum-different bands and their applications. 1.4 Types of electronics communication-simplex, duplex, analog and digital. 1.5 Application of communication 1.6 Define Modulation and need of modulation 1.7 Types of modulation – AM-amplitude modulation, FM – frequency modulation, PM – phase modulation. 1.8 Define Noise ,origin of noise Classification of noise External, internal, atmospheric, thermal, Shot transit time, partition, flicker and white noise 1.9 Definition of Noise Figure and S/N ratio	06
2.Amplitude Modulation and Demodulation	1. Define the terms related to AM modulation 2. State different types of modulation. 3. Describe principle of AM frequency spectrum 4. Describe AM frequency spectrum 5. Describe principle of SSB 6. Describe principle of DSB 7. Define the terms related to demodulation 8. Describe AM detectors. 9. Calculate/ Find modulation Index of AM wave	Modulation theory 2.1 Modulation index, sidebands , power contents , bandwidth, definitions and numerical based on these. Amplitude Modulation theory-mathematical expression. 2.2 Representation of AM in time domain. 2.3 Frequency spectrum in AM wave 2.4 Total power relation in AM-derivation and simple numerical 2.5 Power in side bands-derivation and numerical.	10

		AM transmitter 2.6 Generation of AM (low level and high level transmitter block diagram). 2.7 Collector modulated BJT amplifier 2.8 DSBSC- double side band s suppresses carrier, block diagram and waveforms. 2.9 SSBSC - single side band suppress carrier, block diagram and waveforms. 2.10 Balanced modulator using diode circuit diagram and working. 2.11 Definition of amplitude demodulation. 2.12 AM detectors. 2.13 Diode detector circuit diagram and description. 2.14 BJT detector circuit diagram and description	
3.Frequency Modulation and Demodulation	1. Define the terms related to frequency modulation 2. State merits and demerits of FM over AM 3. Compare AM, FM , PM 4. Describe different types of modulators. 5. Describe the function of demodulators of FM 6. Calculate the modulation Index of FM.	3.1 Definition of FM and PM. 3.2 FM theory - mathematical representation 3.3 Characteristics of FM 3.4 Definitions of modulation Index and Bandwidth in FM, Numerical on Modulation Index. 3.5 Merits and demerits of FM over AM 3.6 Comparison between AM, FM, PM 3.7 Pre-emphasis and de-emphasis circuit diagram and curves. 3.8 FM transmitter. 3.8.1: Basic block diagram 3.8.2: FM generators circuit diagrams and description 3.8.3: FET reactance modulator circuit diagrams and description 3.8.4: Varactor diode modulator circuit diagrams and description 3.8.5: Concept of Narrow band and wide band FM and their comparison 3.8.6: Armstrong FM system	10

		circuit diagrams and description 3.9 Definition of frequency demodulation 3.10 FM demodulators 3.10.1: Balanced slope demodulator circuit diagrams and description 3.10.2: phase discriminator circuit diagrams and description 3.10.3: Ratio detector circuit diagrams and description	
4. Antenna	1. Define terms related to Antenna 2. Describe Radiation mechanism of Antenna 3. Describe ground effect on Antenna 4. Describe different types of antennas	4.1 Radiation mechanism. 4.2 Types of antennas. Resonant and non- resonant antennas 4.3 Definitions of :Directive gain, directivity, Power gain, Antenna resistance , Antenna efficiency, Band width , Beam width , Polarization, Effective radiated power, 4.4 Effect of ground on antenna 4.5 Directional high frequency antenna: construction and radiation pattern. Dipole arrays, Broad side array, End fire array, Folded dipole. Yagi-uda antenna. 4.6. UHF and Microwave antenna: constructional diagram, radiation pattern Parabolic Antenna, Turnstile antenna, Rhombic , Horn, loop antenna	06
5. Signal Transmission	1. Define terms related to transmission lines 2. State different losses in transmission lines. 3. Describe different types of Cables 4. Describe transmission line components 5. Define electromagnetic 6. radiation and propagation of waves 7. State different types of propagation 8. Define the terms related to propagation	Introduction to transmission lines i) Line communication 5.1 Types of transmission lines . 5.2 Equivalent circuit of a parallel wire line their advantages and disadvantages 5.3 Coaxial cables-construction advantages and disadvantages. 5.4 Characteristic impedance. 5.5 Losses in transmission lines 5.6 Standing waves, Standing wave ratio and Reactance properties of Transmission line. 5.7 Transmission line	10

	9. Describe different types of propagation	components- double stub and Directional coupler. 5.8 Electromagnetic radiation , ii)Wireless communication 5.9 Ground waves, Sky waves- definition and concepts of Critical frequency , Skip distance and MUF and Space waves. 5.10 Tropospheric propagation	
6. Radio Receivers	1. Define the terms related to radio receiver 2. Describe the functioning of radio receiver 3. Describe Image frequency and its rejection 4. Describe the principle and functioning of Super heterodyne Radio receiver 5. Analyze the different sections of Radio receiver.	6.1 Characteristic of radio receiver. 6.2 Types of radio receiver. 6.3 Principle and block diagram of Tuned radio frequency (TRF)). 6.4 Principle and block diagram of Super heterodyne receivers. 6.5 Electronic tuning 6.6 Image frequency and its rejection 6.7 Double spotting frequency 6.8 Stereophonic FM receiver	06
Total Hrs.			48



B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	i) Connect the AM wave generator circuit to observe the AM wave pattern on CRO ii) Calculate modulation index..	Amplitude Modulation and Demodulation	4
2	Connect the AM demodulation circuit and plot the output waveform observed for various AM input signal.		4
3	Connect Balance Modulator circuit and observe the AM waveform		2
4	i)Connect the FM wave generator circuit to observe the FM wave pattern on CRO ii)Calculate modulation index	Frequency Modulation and Demodulation	2
5	Connect the FM demodulation circuit and plot the output waveform observed for various FM input signal .		2
6	Find the gain and beam width of YagiUda Antenna.	Antenna	4
7	Measure front to back ratio of YagiUda antenna.		2
8	Connect the Yagi-Uda Antenna to measure radiation with distance.		2
9	Measure the attenuation along the transmission line - Coaxial cable	Signal Transmission	2
10	Measure the standing wave ratio (SWR) along the transmission line – Coaxial cable..		2
11	Find the faults i) Tuner section ii) IF section iii) Detector section iv) power amplifier section in radio receiver	Radio Receivers	2
12	Find the effect of AGC on Radio receiver		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	Communication fundamentals	04(02)	06(04)	00(00)	10(06)
02	Amplitude Modulation and Demodulation	02(04)	08(04)	06(00)	16(08)
03	Frequency Modulation and Demodulation	04(00)	04(08)	06(00)	14(08)
04	Antenna	02(00)	08(00)	00(06)	10(06)
05	Signal Transmission	02(00)	08(00)	00(06)	10(06)
06	Radio Receivers	04(02)	00(04)	06(00)	10(06)
	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	2	R	2	4	R	2	5	R	2	6	R	2	6	R	2	1	R	2	5/7
	6	R	2																
02	1	R	4	2	U	4	3	R	4	1	U	4	3	U	4				3/5
03	5	U	4	2	U	4	4	U	4	2	U	4	3	U	4				3/5
04	4	U	4	5	U	4	3	U	4	2	R	4	6	U	4				3/5
05	1	U	6	2	A	6	4	A	6										2/3
06	3	A	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	Drawing circuit diagram and waveforms, selection of equipment's. writing procedure etc.	10
2	Performance	10
3	Calculation, Result, Drawing Graphs	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	-	-
2	-	3	-	-	-	-	-	-	-	3	-	3
3	-	3	-	-	-	-	-	-	-	3	-	3
4	-	3	2	2	-	-	2	2	-	3	2	3
5	-	3	2	2	-	-	2	2	-	3	2	3
6	-	3	2	2	-	-	2	2	-	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.	Electronic Communication System	George Kennedy McGraw-Hill, 4th Edition , 1992	10: 0071126724 13: 978-0071126724
2.	Communication Electronics-Principles and applications	Louis E. Frenzel: McGraw-Hill, 1999	10: 0070483981 13: 9780070483989
3.	Electronic Communication	Dennis Roddy , Pearson Education India, 1977	8177585584, 9788177585582

❖ **E-REFERENCES:**

1. http://www.pa2old.nl/files/am_fundamentals.pdf, assessed on 19th September 2016
2. <http://www.radio-electronics.com/info/rf-technology-design/fm-reception/fm-demodulation-detection-overview.php>, assessed on 19th September 2015
3. <https://www.youtube.com/watch?v=CGEnJNC4sRo#t=3.825057>, assessed on 19th September 2015

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

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. CRO
4. Digital Multi-meter

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

S.N.	Name	Designation	Institute / Industry
1.	Mrs R. R. Vairagade	Lecturer in Electronics & Telecomm Engineering	Govt. Polytechnic Nagpur
2.	Mrs.U.M. Ramteke	Lecturer in Electronics & Telecomm Engineering	Govt. Polytechnic Nagpur
3.	Mrs U. P. Potdar	Lecturer in Electronics & Telecomm Engineering	Govt. Polytechnic Nagpur
4.	Mr. Sandip V Darwhekar	Director	Beta Computronics Pvt ltd , Nagpur
5.	Mrs Gajala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
6.	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 ELECTRONICS & TELECOMM. ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC404E
COURSE TITLE	: CIRCUIT ANALYSIS AND SIMULATION.
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:

This course lays emphasis on basic laws, theorems and techniques for network analysis which helps students to find different electrical parameters for a given network. It forms the foundation to understand various application level subjects such as electrical machines, power systems, measurements and control. The study of this subject will facilitate student have a firm grasp on the basic principles of circuit and networks, design, analysis and simulation.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply network theorems and laws in simplification of networks.
2. Solve numerical on DC networks using network theorems and laws.
3. Design two port networks and filter networks.
4. Assemble resistive networks on breadboard.
5. Measure different electrical parameters of network using multi-meter.
6. Use simulation software for design and simulation of networks.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Network Elements and laws. (only DC Resistive circuits)	1. Define branch, node and mesh. 2. Classify different types of network elements. 3. Define time constant and state its importance. 4. Describe the charging and discharging of capacitor with the help of waveforms. 3. Compare different types of network elements. 4. State and describe Kirchhoff's Voltage law and Kirchhoff's Current law with the help of example. 5. Find equivalent resistance for a given DC resistive network. 6. Solve series and parallel combination of resistances in a given network. 7. Apply voltage and current division method or use KVL or KCL in finding unknown value of current or voltage in a given network.	1.1 Introduction to network elements Resistor, Inductor, Capacitor. 1.2 Definition of branch, node and mesh. 1.3 Charging and discharging of capacitor, circuit diagram, working and importance of time constant. 1.4 Classification of network elements and their comparison. a) Active and Passive b) Unilateral and Bilateral c) Linear and Non Linear 1.5 Series and Parallel combination of resistances, method, formula, practice problems on finding equivalent resistance. 1.6 Voltage division and Current division, method, formula and practice problems. 1.7 Principle of duality, duality pairs, practice problems on finding dual of given network. 1.8 Kirchhoff's current law (KCL) statement, practice problems to find unknown value of current and voltages for a given network. 1.9 Kirchhoff's voltage law (KVL) statement, practice problems to find unknown value of current and voltages for a given network.	08
2. Principles of Circuit Analysis (only DC Resistive circuits)	1. State source transformation method. 2. State the importance of super nodal analysis and super mesh analysis with the help of example. 3. Obtain star connected equivalent for the delta connected circuit and vice-versa. 4. Describe the mesh and nodal analysis method. How it can be used to find	2.1 Source Transformation method, conversion of independent sources from voltage source to current source and vice versa, practice problems on conversion of independent sources. 2.2 Star to Delta Transformation, formula, practice problems. 2.3 Delta to Star Transformation, formula, practice problems. 2.4 Mesh Analysis and Nodal Analysis, procedure, numerical up to three simultaneous	08

	mesh currents in a given network. - Determine equivalent voltage source from the given current source and vice-versa. - Find branch currents and voltage at each node respectively for a given network using mesh analysis and nodal analysis - Apply the concept of super mesh and super node analysis to find mesh currents and nodal voltages respectively.	equations. 2.5 Concept of Super Mesh and Super Node, importance, procedure, numerical up to three equations.	
3. Network Theorems (only DC Resistive circuits)	- State Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem or Maximum power transfer theorem. - Find the voltage across a resistor in a given network using superposition theorem. - Determine Thevenin's equivalent circuit across two terminals for a given network. - Apply Norton's theorem to find voltage drop across resistor in a given network. - Apply reciprocity theorem to DC resistive network. Analyze the results. - Find value of load resistance when load resistance draws maximum power using maximum power transfer theorem.	3.1 Statement, procedure, and practice problems on – 3.1.1 Superposition theorem. 3.1.2 Thevenin's theorem. 3.1.3 Norton's theorem. 3.1.4 Reciprocity Theorem. 3.1.5 Maximum power transfer theorem	10

4. Resonant Circuits	1. State the importance of resonance. 2. State the effect of quality factor on bandwidth for series RLC circuit. 3. Describe the working of series and parallel resonant circuits. 4. Derive the expression of resonant frequency for series and parallel resonant circuit. 5. Describe the variation of impedance with frequency for a series and parallel resonant circuit using waveforms. 6. Derive resonant frequency for a Tank circuit. 7. Determine the value of C, L, Q, and BW at resonance for series resonant circuit, if resonant frequency is given. 8. Determine the resonant frequency, impedance of series and parallel resonant circuit if value of inductance and capacitance is given. 9. Determine resonant frequency, for a given tank circuit	4.1 Importance of resonance and its types. 4.2 Series resonance, circuit diagram, working, condition for series resonance and resonant frequency. 4.3 Variation of impedance, voltage and current with frequency for series resonant circuit. 4.4 Bandwidth of RLC circuit. 4.5 Quality factor and its effect on bandwidth. 4.6 Parallel resonance, circuit diagram, working, condition for parallel resonance, resonant frequency. 4.7 Resonant frequency for a tank circuit. 4.8 Variation of impedance with frequency for parallel resonant circuit. 4.9 Q factor for parallel resonant circuit.	08
5. Two port Networks and Filter Networks.	1. Define two port networks. 2. Draw the block diagram of two port network. 3. Draw frequency response of low pass, high pass, band pass, and band stop filters. 4. State the formula of load resistance and cut-off frequency for constant-k low pass and constant-k high pass filters. 5. Derive Z and Y parameters of a two port network. 6. Derive transmission (ABCD) parameters and hybrid parameters of a two	5.1 Definition and block diagram of two port network. 5.2 Open circuit impedance (Z) parameters, derivation of Z parameters (Z_{11}, Z_{12}, Z_{21}, and Z_{22}), practice problems on finding Z parameters. 5.3 Short circuit admittance(Y) parameters, derivation of Y parameter (Y_{11}, Y_{12}, Y_{21}, Y_{22}), practice problems on finding Y parameters. 5.4 ABCD (transmission) parameters, derivation of ABCD parameters, practice problems on finding ABCD parameters. 5.5 Hybrid parameters, derivation of hybrid parameters (h_{11}, h_{12},	10

	port network. 7. Find Z and Y parameters for the given network. 8. Find ABCD parameters and hybrid parameters for the given network. 9. Design low pass and high pass filter (both T and π sections) having cut off frequency 2KHz and load resistance 500 Ω	h21, h22), practice problems on finding hybrid parameters. 5.6 Types of filters, definition and frequency response of low pass, high pass, band pass, and band stop filters. 5.7 Classification of filter networks, structure of T, π and Ladder networks. 5.8 Constant K low pass filters, design using T and π sections, 5.9 Constant K high pass filters, design using T and π sections. 5.10 Design impedance (k), series inductance (L), shunt capacitance (C) and cut-off frequency (f_c) for constant K low pass filters and constant K high pass filters.(only equations)	
6. Network Analysis with SPICE	1. Identify the importance of PSPICE software in circuit analysis. 2. Develop the PSPICE program for a given resistive network and find node voltages and mesh currents. 3. Develop the PSPICE program for series RLC circuit. 4. Analyse the results.	6.1 PSPICE Introduction, commands (.OP, .END, .PRINT, .DC, .PROBE, .AC, .TRAN) syntax, simulation steps. 6.2 DC analysis of resistive circuits. 6.3 Transient (time domain) analysis. 6.4 AC analysis, 6.5 Frequency response of RLC circuit using PSPICE. 6.6 Design of low pass and high pass filters using PSPICE	04
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs
1.	Assemble series resistive circuit on breadboard and analyze the result using Kirchhoff's voltage law.	Network elements and laws	4
2	Assemble parallel resistive circuit on breadboard and analyze the results using Kirchhoff's current law.		4
3	Assemble RC circuit on breadboard to study the charging and discharging of capacitor. Calculate value of time constant and Plot RC waveform for square wave signal.		4
4	Assemble resistive circuit on breadboard, measure mesh currents and compare it with theoretical results (use mesh analysis)	Principles of circuit analysis	4
5	Assemble resistive circuit on breadboard, measure voltages at each node and compare it with theoretical results (use nodal analysis)		4
6	Assemble resistive network on bread board with two or more energy sources, measure current at any branch and compare it with theoretical results using Superposition theorem.	Network Theorems	4
7	Assemble resistive network on bread board, measure voltage at any branch and compare it with theoretical results using Thevenin's theorem.		4
8	Assemble resistive network on bread board, Determine current at any branch and compare it with theoretical results using Norton's theorem.		4
9	Assemble resistive network on bread board, apply reciprocity theorem and analyze the results.		4
10	Determine the mesh currents for resistive network using PSPICE. Compare it with theoretical results (use Mesh analysis)	Circuit analysis with SPICE	4
11	Calculate the mesh currents for resistive network having common current source between two adjacent loops using PSPICE. Compare it with theoretical results (use Super mesh technique)		4
12.	Calculate the nodal voltages for any resistive network using PSPICE. Compare it with theoretical results (use Nodal analysis)		4
13	Use PSPICE to calculate the nodal voltages for resistive network having common voltage source between two adjacent nodes. Compare it with theoretical results (use Super nodal technique)		4
14.	Use PSPICE to calculate cut-off frequency of high pass filter and compare it with theoretical results.		4
15.	Calculate cut-off frequency of low pass filter using PSPICE and compare it with theoretical results.		4
16.	Determine the resonant frequency of RLC series circuit using PSPICE.		2
Skill Assessment			02
Total Hours			64

❖ SPECIFICATION TABLE FOR THEORY PAPER :

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Network Elements and Laws	06(02)	04(00)	00(04)	10(06)
02	Principles of Circuit Analysis	02(02)	06(00)	04(06)	12(08)
03	Network Theorems	02(00)	06(06)	06(04)	14(10)
04	Resonant Circuits	02(00)	10(04)	00(00)	12(04)
05	Two port networks and filter networks	02(00)	08(04)	04(04)	14(08)
06	Network analysis with SPICE	00(00)	00(04)	08(00)	08(04)
	Total	14(04)	34(18)	22(18)	70 (40)

❖ 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	1	R	2	5/7
	2	R	2																
02	1	R	4	2	R	2	2	A	4	1	A	4	5	A	4				3/5
03	1	U	4	3	U	4	6	A	4	3	A	4	5	U	4				3/5
04	3	U	4	4	U	4	6	A	4	4	U	4	6	U	4				3/5
05	2	U	6	3	A	6	3	U	6										2/3
06	3	U	6	4	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	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 on breadboard	20
3	Observations, calculations, 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	2	-	-	-	3	-	3	3	3
2	-	3	3	-	-	-	-	3	-	3	-	-
3	-	3	3	-	-	-	-	3	-	3	-	-
4	-	3	3	-	-	-	-	3	-	3	3	3
5	-	3	3	2	-	-	-	3	-	3	3	3
6	-	3	3	2	-	-	-	3	-	3	3	3

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

❖ REFERENCE & TEXT BOOKS:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Circuits and Networks, Analysis and Synthesis	A Sudhakar & Shyammohan S Palli, Tata McGraw-Hill, Fifth Edition, 2006	13: 978-93-392-1960-4 10: 93-392-1960-0
2.	Fundamentals of Electrical Networks	B. R. Gupta & Vandana Singhal, S Chand & company ltd, Fifth Edition, 2005	13: 9788121923187 10: 8121923182
3.	Theory and Problems in Circuit Analysis	T S K V Iyer, Tata McGraw-Hill, First Edition, 1995	0074621653 9780074621653
4.	Fundamentals of Electric Circuit Theory	D Chattopadhyaya & P. C. Rakshit, S. Chand, Seventh Revised Edition, 2006	10: 8121900085 13: 978-8121900089
5.	Network Analysis	M. e. Van Valkenburg, Prentice Hall of India, Third Edition, 1997	13: 978-0136110958 10: 0136110959

❖ **E-REFERENCES:**

- [http:// www.allaboutcircuits.com](http://www.allaboutcircuits.com) , assessed on 18th January 2016
- https://www.youtube.com/results?search_query=resistive+networks, assessed on 12th July 2016

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

- Digital Multi-meter.
- Cathode Ray Oscilloscope 0 to 20Mhz
- Desktop Computer installed with PSPICE Software.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Prof. S. S. Tadas	Head of Department (Electronics and Tele-Comm Engg.)	Government Polytechnic, Nagpur.
2.	Prof. Mrs. M. N. Bawne	Lecturer (Selection Grade)	Government Polytechnic, Nagpur.
3.	Prof. V. M. Sakode	Lecturer	Government Polytechnic, Nagpur.
4.	Shri. Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
5.	Mr. S. M. Kale	Lecturer in Electronics	Government Polytechnic, Gadchiroli
6.	Mrs. Gazzala.Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS AND TELE.COMM ENGG

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC405E^{\$}

COURSE TITLE : MICROCONTROLLER

PREREQUISITE : EC402E

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 : 04 HRS

PR TEE : 02 HRS (External)

PT. : 01 HR

❖ RATIONALE:

This course forms the foundation of Microcontroller to the students of Electronics Engineering. It deals with learning the need & concepts of different types of microcontrollers and their features inside of a Microcontroller related to hardware, instructions and programming. Now a day many electronic systems starting from electronic toys, house hold equipment to industry based machines needs proper controlling as per demand. Hence, it is necessary to know the concept of controlling mechanism system. This course emphasizes on the basics of Microcontroller and its developments to controlling application of different devices interfaced in a complex system.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze features of various microcontrollers.
2. Identify pins of IC 8051 & hardware component inside a Microcontroller
3. Select proper instruction and develop a program for a Microcontroller based application
4. Use simulator software for executing assembly language program
5. Develop and execute assembly language program
6. Develop program to interface microcontroller with LED/SWITCH

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Microcontrollers	1. Interpret Evolution of Microcontroller 2. Draw Block diagram of Microcomputer, Discriminate elements of Microcomputer, types of buses 3. Illustrate Von Neuman and Harward Architecture 4. Compare Microprocessors & Microcontrollers 5. Describe need of Microcontroller 6. Describe different family of Microcontrollers 7. Describe specifications of 8051, 8751, 8951, 89C1051, 89C2051, 89C4051 Microcontrollers and compare them.	1.1 Evolution of Microcontrollers 1.2 Block diagram of Microcomputer, elements of Microcomputer, types of buses 1.3 Von Neuman and Harward Architecture 1.4 Compare Microprocessor and Microcontrollers 1.5 Need of Microcontroller 1.6 Family of Microcontrollers and their specifications 1.7 Versions of Microcontroller 8951, 89C1051, 89C2051, 89C4051 with their specifications and comparison	08
2. Architecture of Microcontroller 8051	1. Draw the block diagram of 8051 and describe its function 2. Draw pin diagram of 8051 and state functions of pins 3. Illustrate concept of Internal and External Memory 4. Describe reset circuitry and clock circuitry for 8051 5. List and describe different Registers and SFRs of 8051 6. Analyse internal RAM structure of 8051	2.1 Block diagram of 8051, function of each block 2.2 Pin diagram, function of each pin 2.3 Concept of Internal memory and External memory (RAM and ROM) 2.4 Internal RAM structure 2.5 Reset and clock circuit 2.6 Various registers and SFRs of 8051	10
3. 8051 Instruction set and programs	1. Classify 8051 instructions and its format 2. Describe various addressing modes of 8051 3. Classify various instructions 4. Describe each instructions based on its format, operation performed, addressing mode, op-code, no of machine cycles used, condition of different flags etc with example.	3.1 Overview of 8051 instruction set 3.2 various addressing modes 3.3 Classification of instructions 3.4 Data transfer instructions 3.5 Arithmetic instructions 3.6 Logical instructions 3.7 Branching instructions 3.8 Bit manipulation instructions 3.9 stack, subroutine and interrupt related instructions 3.10 programs based on above instructions	12

	5. Identify addressing modes for different Instructions. 6. Develop programs for different task using various instructions.		
4. Assembly Language programming	1. Interpret software development steps and tools like Editor, Assembler, Linker, Loader, Hex converter 2. Describe various files created to run a 8051 program using simulators software 3. Describe the use of various directives in Assembly language program 4. Select proper directives to develop different programs.	4.1 Software development steps 4.2 software development tools like Editor, Assembler, Linker, Loader and Hex converters. 4.3 Role of various files created at various levels in running a Assembly program using simulators like RIDE or KEIL. 4.4 Various directives of Assembly language programming 4.5 Programs using directives.	12
5. 8051 Internal Peripherals and related programs	1. Describe the concept of I/O ports and related SFRs 2. Describe the concept of Timer/counter and related SFRs 3. Describe the concept of serial communication and related SFRs 4. Describe the concept of Interrupts and related SFRs 5. Describe the power saving modes 6. Develop assembly language programs using peripherals	5.1 I/O ports- List, diagram, read write operation, instructions and related SFRs 5.2 Timers/counters – list, related SFRs, programming modes, operations with diagram. 5.3 serial communication- Basics of serial communication, baud rate, related SFRs, programming modes, operations with diagram. 5.4 Interrupts- related SFRs, types, operations with diagram. 5.5 Power saving operation- modes, related SFR,	12
6. External memory/IO interfacing	1. State types of semiconductor memory 2. Describe memory organization.& address decoding diagram for given size of RAM/ROM and memory map 3. State the function of Pin diagram and Block diagram of 8255 a 4. Describe modes of operation of 8255 5. Develop program for interfacing of 8255 with Microcontroller using I/O like LED, switch	6.1 semiconductor memory – types, memory organization 6.2 memory address decoding 6.3 interfacing of External Data & program memory (RAM and ROM)- diagram, memory map (various option) 6.4 IC 8255- Pin diagram, Block diagram, 5.5 modes of operation 6.5 Interfacing of IC 8255 with microcontroller using LED and switch.	10
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Interpret details of Hardware kit for Microcontroller and practice to write & execute programs	8051 Instructions and programs	02
2	Identify different menus available in a simulator software RIDE/KEIL and demonstrate their use.	Assembly Language program	02
3	Develop & execute Assembly language programs using Arithmetic Instructions and demonstrate outcome for a given input data	8051 Instructions and programs	04
4	Develop & execute Assembly language programs using Logical Instructions and demonstrate outcome for a given input		04
5	Develop & execute an Assembly language program for Addition of series of 8 bit no's 16 bit result and demonstrate outcome for a given input data		02
6	Develop & execute Assembly language program for addition/subtraction of 16 bit no/multi byte nos. and demonstrate outcome for a given input data		02
7	Develop & execute Assembly language program for Block transfer from& to Internal/External memory using directives and demonstrate outcome for a given input data	Assembly Language program	04
8	Develop & execute Assembly language program Largest/smallest of given series of no. from Internal/External memory and demonstrate outcome for a given input data		02
9	Develop & execute Assembly language program arrange no in ascending/descending order from Internal/External memory and demonstrate outcome for a given input data		04
10	Develop & execute Assembly language program for LED blinking/LED sequences using delay/timer mode	8051 Internal Peripherals and related programs	02
11	Develop & execute Assembly language program to interface LED with microcontroller		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	Introduction to Microcontrollers	02(00)	04(04)	00(00)	06(04)
02	Architecture of Microcontroller 8051	02(04)	06(04)	04(00)	12(08)
03	8051 Instruction set and programs	02(00)	06(04)	08(02)	16(06)
04	Assembly Language programming	02(04)	04(00)	04(00)	10(04)
05	8051 Internal Peripherals and related programs	04(00)	06(06)	06(04)	16(10)
06	External memory/IO interfacing	04(02)	06(00)	00(06)	10(08)
	Total	16(10)	32(18)	22(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	2	U	2	3	R	2	4	R	2	3	A	2	5/7
	6	R	2																
02	1	U	4	2	U	4	3	A	4	1	U	4	3	U	4				3/5
03	2	A	4	3	A	4	4	U	4	2	R	4	4	R	4				3/5
04	4	A	4	5	R	4	6	R	4	2	U	4	5	A	4				3/5
05	5	U	6	6	U	6	5	U	6										2/3
06	3	U	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	Writing a program, converting it into Machine language	10
2	Performance	15
3	Showing execution process and outcome	15
4	Viva voce	10
	TOTAL	50

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

Course Outcomes	Programme 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	2	-	-	2	2	-	3	3	3
5	-	3	3	2	-	-	2	2	-	3	3	3
6	-	3	3	2	-	-	2	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.	The 8051 Microcontroller And Embedded Systems Using Assembly And C, 2/E	Mazidi, Pearson Education, Asia 2007, second edition	8131710262, 9788131710265
2.	The 8051 Microcontroller, Architecture, Programming and Applications	Kenith Ayala, Penram International Publication. 1996	9780314201881
3.	The 8051 Family of microcontroller	Rechard H. Barnett, Prentice Hall, 1995	00230628198051

❖ **E-REFERENCES:**

- <http://www.electronicshub.org/8051-microcontroller-projects-engineering-students/>, assessed on 13th October, 2016
- <http://www.electronicshub.org/difference-between-microprocessor-and-microcontroller/>, assessed on 13th October, 2016

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

1. Microcontroller 8051 kits.
2. RIDE simulator software
3. KEIL simulator software
4. Desktop PC

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. A A Ali	HOD, Electronics & Telecomm Engineering (II Shift)	Government Polytechnic, Nagpur.
2.	Mrs. P.H. Gedam	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mr. V M Sakode	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mr. S. D. Ambade	Lecturer in Electronics & Telecomm Engineering	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 ELECTRONICS & TELECOMM. ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC406E ^{\$}
COURSE TITLE	: LINEAR INTEGRATED CIRCUITS
PREREQUISITE	: EC301E
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 (External)
PT.	: 01 HR

❖ RATIONALE:

This course focuses light on the commonly used linear ICs like operational amplifiers, timers and PLL. More emphasis is given to the analysis of the application circuits using the IC's mentioned in various topics. This course acquaints student with general analog principles and design methodologies using integrated circuit for system design.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze different operational amplifier circuits.
2. Select an Op Amp circuit for a particular application.
3. Design different application circuits using timer ICs and Op-Amp.
4. Assemble circuits using Op Amp and timer ICs.
5. Test the performance of the circuits for a particular application.
6. Interpret the characteristics and waveforms of electronic circuits.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Operational Amplifier	1. Draw a block diagram of op-Amp and explain the function of each block. 2. Define different parameters of op-Amp 3. Describe ideal Characteristics of op-Amp. 4. Draw the pin diagram of IC741 and describe pin functions. 5. Determine the closed loop voltage gain, input resistance, output resistance, bandwidth, and total output offset voltage. 6. Describe circuit and pin diagram of IC LM358.	1.1 Importance of operational amplifier(op amp) 1.2 Basic block diagram of op- amp 1.3 Circuit Symbols and Terminals of op-amp 1.4 Requirement of Supply voltage. 1.5 Op-amp IC's: 741, diagram and pin function. 1.5 Ideal op-amp characteristics. 1.6 Study of parameters of op-amp- • Input offset voltage • Input offset current • Input bias current • differential input resistance • Input capacitance • Input voltage range • Common mode rejection ratio(CMMR) • Supply voltage rejection ratio(SVRR) • Large signal voltage gain • Supply voltages • Supply current • Output voltage swing • Output resistance • Slew rate • gain bandwidth product • Output short circuit current. 1.7 Study of IC741 datasheet. 1.8 Offset voltage adjustment. 1.9 Open loop and closed loop configuration of op-amp. 1.10 Introduction to IC LM358, 1.11 Pin diagram of IC LM358	06
2. Basic op-amp circuits	1. Draw different op amp circuits. 2. Describe the working of various op amp circuits. 3. Derive the voltage gain equation for different op amp circuits 4. Analyze different op	2.1 Virtual ground concept 2.2 Circuit diagram, derivation, working of Op-amp as • An inverting amplifier, sign changer • Non-inverting amplifier, Voltage follower • Inverting and non-inverting	10

	amp circuits 5. Calculate the gain/ output voltage for different circuits 6. Design adder/ differential amplifier circuit.	Adders(summing amplifier, scaling Amplifier, averaging amplifier), • Differential amplifier (Subtractor) • Basic and Practical Differentiator • Basic and Practical Integrator • Voltage to current converter(with floating load, with grounded load) • Current to voltage converter	
3. Special op-amp circuits	1. Draw different special op amp circuits. 2. Derive the output voltage equation for instrumentation amplifier (2 op-amps, 3 op-amps) 3. Describe the operation of various special op amp circuits. 4. Analyze different special op amp circuits 5. Draw the input, output waveforms for different comparator circuit. 6. State the applications of voltage comparator.	3.1 Necessity and requirements of instrumentation amplifier. 3.2 Instrumentation amplifiers using 2 op-amps and 3 op-amps, derivation of output voltage equation. Advantages and applications of instrumentation amplifier. 3.3 Log and antilog Amplifier, 3.4 Multiplier and divider using log, antilog amplifiers. 3.5 Sample and hold circuits, advantages and applications. 3.6 Basic concepts, transfer characteristic and applications of voltage comparator. 3.7 Circuit diagram, working and waveforms of • Inverting and non-inverting comparators, • Inverting and non-inverting Zero-crossing detector, • Phase detector • Peak detectors and Peak to Peak detector • Window detector.	20
4. Waveform generators and special analog ICs	1. Draw circuits of different oscillators, multivibrators and waveform generators 2. Draw waveforms of different multivibrator circuits 3. Draw the pin diagram of different ICs. 4. Describe the function of different pins of ICs	4.1 Circuit diagram, working, waveforms and application of • Wien bridge oscillator, Phase-shift oscillator and Quadrature oscillator. • Op-amp as Astable, Monostable and Bistable multivibrator. • Schmitt trigger circuit, definition of Upper threshold point (UTP) and Lower	12

	5. Describe the operation of different oscillators, multivibrators and waveform generators 6. Calculate the frequency/time period of oscillation for oscillators/multivibrators 7. Analyze different multivibrator/oscillator circuits.	threshold point (LTP). • Square and triangular wave generators. • Pulse generator. 4.2 Block diagram description, Pin diagram and circuit diagram of Fixed voltage regulator IC78xx, 79xx (3-pin regulator) 4.3 Pin diagram and description, typical circuit of Audio amplifier LM380, Function generator IC8038.	
5. Active filters	1. Classify the filters. 2. Draw ideal and practical characteristics of different filters. 3. Define terms related to filters. 4. Describe the working of different filters with the help of circuit diagram. 5. Compare active and passive filters. 6. Design different types of filters. 7. Analyze different filters.	5.1 Definition and need of filters. 5.2 Classification of filters. 5.3 Passive and Active filters, merits & demerits. 5.4 Terms related to filters, Cut off frequency, Pass band, stop band, center frequency, roll off rate, BW (bandwidth), Q factor. 5.5 Ideal and Practical frequency response of different types of filters. 5.6 Circuit diagram and working of • First order and second order low pass Butterworth filter. • First order and second order high pass Butterworth filters.	10
6. Electronic timer and phased lock loop.	1. Describe block diagram, pin diagram, operating principle of IC555. 2. Describe various multivibrator circuits using IC555 and also draw their input, output waveforms. 3. Describe the working operation, pin configuration, block diagram of voltage controlled oscillator. 4. Describe the operating principle, block diagram of phase-locked loop. 5. Describe the operation, pin configuration of a	6.1 Introduction and important features of timer IC 555. 6.2 Functional block diagram and working of IC555. 6.3 IC555 pin configuration, pin functions, specifications and applications of IC555. 6.4 Circuit diagram, working and waveforms of • Astable, Monostable and Bistable multivibrator using IC 555. • Monostable ramp generator. • Free-running ramp generator. • Schmitt trigger circuit using IC555. • Pulse width modulator. • Missing pulse generator. • Voltage controlled oscillator.	06

	PLL IC 565. 6. State the applications of PLL as frequency multiplier.	6.5 Basic principle and block diagram of phase locked loop (PLL). 6.6 Pin configuration of PLL IC 565 and pin functions of IC565(PLL) 6.7 Applications of PLL as frequency multiplier, FM demodulator.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Assemble Inverting and Non-Inverting amplifier using IC 741. Determine the gain and compare it with theoretical gain.	Basic OP-AMP Circuits	2
2.	Assemble adder / subtractor circuit using IC 741 and measure the output voltage for given input voltage.		2
3.	Assemble differentiator / integrator circuit using op-amp. Plot the output waveforms for sine wave and square wave input.		2
4.	Assemble inverting and non-inverting Zero Crossing detector using Op-amp. Interpret input and output waveforms.	Special OP-AMP applications, comparators	2
5.	Assemble circuit of A stable multivibrator using IC741/IC555. Plot output waveform and determine frequency and duty cycle.	Waveform generators and special analog ICs	4
6.	Assemble circuit of Schmitt Trigger using IC741 Plot output waveform and find out UTP and LTP.		4
7.	Measure delay time (T) of Mono stable multivibrator using IC555 and Plot output waveform.		2
8.	Measure time period of output waveform of Weinbridge / RC phase shift oscillator using IC 741 and find out its frequency of oscillation for various values of R.		4
9.	Connect Butterworth first order low pass filter / high pass filter using op-amp and plot the frequency response.	Active filters and phased locked loop.	4
10.	Assemble function generator circuit using IC 8038 and plot different output waveforms.	Waveform generators and special analog ICs	4
Skill Assessment			02
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Sr.No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Operational Amplifier	02(02)	08(04)	00(00)	10(06)
02	Basic op-amp circuits	00(02)	04(04)	08(00)	12(06)
03	Special op-amp applications and comparators	02(00)	08(04)	08(06)	18(10)
04	Waveform generators and special analog ICs	02(00)	04(08)	06(00)	12(08)
05	Active filters	02(00)	06(00)	00(04)	08(04)
06	Electronic timer and phased lock loop.	02(00)	04(00)	04(06)	10(06)
	Total	10(04)	34(20)	26(16)	70 (40)

❖ 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	6	R	2	3	R	2	4	R	2	5	R	2	1	R	2	5/7
	2	R	2																
02	1	U	4	2	U	4	6	U	4	3	U	4	4	U	4				3/5
03	4	U	4	2	A	4	3	U	4	4	U	4	2	U	4				3/5
04	2	A	4	1	U	4	3	U	4	1	U	4	6	U	4				3/5
05	3	A	6	6	A	6	4	A	6										2/3
06	5	U	6	5	A	6	3	A	6										2/3

❖ 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	3	-	-	-	3	1	3		-
2	-	-	-	-	-	-	-	-	-	3	3	-
3	-	3	3	3	-	-	-	3	-	3	-	-
4	-	-	3		1	-	-	3	1	3	3	2
5	-	3	3	3	-	-	-	3	-	3	3	2
6	-	-	3	3	-	-	-	3	-	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.	Linear Integrated circuits -	S. Roy Choudhary and Jain , New age International Publishers, 4 th edition ,30 July1996	81-224-1470-2,1906574715,9781906574710
2.	Integrated Circuits	K. R. Botkar., Khanna Publisher, New Delhi,5 th edition,2010	81-7409-208-0.
3.	Operational Amplifiers	R. Gaikwad, Prentice-hall of India New Delhi, 4 th edition, January 1993	0750656948,981-240-062
4.	Operational Amplifiers	Graeme and Tobey,1June 1974	978-0070649170

❖ **E-REFERENCES:**

- www.gurukul.cc/document/lic , assessed on 20th september 2016
- learnabout-electronics.org, assessed on 20th september 2016
- www.ti.com/product/LM358 orgassessed on 20th september 2016
- <https://www.elprocus.com/lm358-ic-pin-configuration-and-applications/> org ,assessed on 20th september 2016

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

1. Cathode ray oscilloscope- 0 to 50 MHz, Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz
2. Function Generator, 1 MHz , sine, square, triangular, ramp and pulse generator Freq range 0.01 Hz to 1 MHz, Output amplitude 20V open circuited, Output impedance 50 ohms.
3. Regulated Power Supply, 0- 30 Volt, 2 A with digital display
4. AF and RF oscillator, RF frequency: 25 MHz - 50 MHz AF Frequency: 400 Hz & 1 KHz AF/ Modulating Frequency: Internal 400 Hz & 1 KHz modulating frequency
5. Pulse generator, portable, minimum frequency range-1.00-12MHz Maximum frequency range->2MHz, pulse duration <.00025microsec.

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics and Telecomm. Engineering (1st shift)	Government Polytechnic, Nagpur.
2.	Mr. A. A. Ali	Head of Electronics and Telecomm. Engineering (2nd shift)	Government Polytechnic, Nagpur
4.	Mrs. M. N. Bawane	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
5.	Ms. P. L. Tirpude	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
6.	Mr. V. M. Sakode	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
7.	Mr. Sandip. V. Darwhekar	Director	Beta computronicspvt ltd , Nagpur
8.	Mrs Gazzala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
9.	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 ELECTRONICS & TELECOMM.ENG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC407E

COURSE TITLE : ELECTRONIC INSTRUMENTATION

PREREQUISITE : NIL

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

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

TH.TEE. : 03 HRS

PR.TEE. : 02HR (Internal)

PT. : 01HRS

❖ **RATIONALE:**

This course is introduced with a view that students will be made aware of various electronic instruments and measuring techniques. It deals with various basic transducers needed for the measurements of various physical parameters, their types and recording systems with interfacing circuits needed in measurements systems. It also deals with various parameter measurement systems.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Illustrate the working of various instruments and their applications.
2. Select the instrument for the measurement of specific electrical parameter.
3. Apply the principle and operation of different measuring instruments.
4. Measure different parameters using electronic instruments.
5. Operate CRO and spectrum analyzer.
6. Test electronic component using CRO.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Instrumentation	1. Define various terms related to instrumentation system. 2. Differentiate static and dynamic characteristics. 3. Describe various International standards. 4. Describe instrumentation system with Block diagram. 5. List the applications of instrumentation system. 6. Identify different methods of Standards in measurement.	1.1 Use and information of instrumentation system in industrial context. Role of instrumentation system in industry. 1.2 Definitions of static and Dynamic characteristics. 1.3 Static characteristics- Accuracy, precision, error. Sensitivity and resolution, repeatability and reproducibility. Linearity and nonlinearity of systems. 1.4 Dynamic characteristics - hysteresis, drift, speed of response, lag, fidelity. 1.5 Standards in measurement, International standards, Primary and secondary standards, atomic, time, Electrical standards. 1.6 Block diagram of instrumentation system and transducer selection factors. 1.7 Applications of instrumentation system.	06
2 Transducers	1. Describe introduction of transducer in Instrumentation. 2. Describe the Classification based on principle of transducer. 3. Describe the working principle of Strain gauges. 4. Describe working of temperature measurement. 5. Describe working of displacement measurement. 6. Describe the working of Flow Measurement. 7. Analyze the working	2.1 Introduction to transducer in Instrumentation -Classification based on principle of transduction, Primary-Secondary, Passive-Active 2.2 Principles of Resistive, Capacitive and Inductive Transducer 2.3 Basic principle of operation, working, construction, advantages, disadvantages and applications of Strain gauges, Pressure, Potentiometer. 2.4. Temperature measurement - RTD, Thermistor; NTC & PTC, Thermocouple, radiation type Pyrometer. 2.5 Displacement measurement- linear variable differential	10

	ofLVDT.	transducer(LVDT), Rotary variable differential transducer(RVDT) 2.6. Level measurement- Resistive method. 2.7. Flow Measurement- Electromagnetic flow meter, Hot wire Anemometer 2.8 Piezoelectric transducer ,photovoltaic transducer 2.9. Proximity sensors, Limit switches	
3 Discrete Component Measurement	1. Derive the general equation form of an AC bridge. 2. Describe the working of Resistance measurement. 3. Describe the working of Low frequency inductance using Maxwell Bridges. 4. Describe the working of capacitance measurement using Schering Bridge. 5. Describe working of LCR meter. 6. Analyze the working of LCR meter.	3.1 Introduction - General bridge configuration for measurement, Equation for Bridge balance, types of bridge depending upon excitation, comparison between AC bridge & DC bridge. 3.2 Resistance measurement- Wheatstone bridge ,derivation for bridge balance, Kelvin's Bridge, Kelvin's double Bridge.(no derivation) 3.3 Low Frequency inductance measurement using Maxwell Bridges, derivation for bridge balance, 3.4 capacitance measurement using Schering Bridge, derivation for bridge balance, 3.5 Principle of basic Q meter, High frequency component measurement using Q-meter. 3.6 Working of LCR meter,digital LCR meter.	8
4 Data Processing And Signal Conditioning	1. Describe the Necessity of DAS and Data logger. 2. Draws block diagram and working of DAS. 3. Draws block diagram and working of Data loggers. 4. Describe the Necessity of signal conditioning circuit. 5. Draw block diagram and working of AC signal conditioning. 6. Describe the working of chopper stabilized	4.1 Necessity of Data Acquisition System (DAS) and Data logger. 4.2 Block diagram and working of DAS 4.3 Block diagram and working of Data loggers, PC based monitoring system 4.4 Introduction to signal conditioning. Necessity of signal conditioning circuit. 4.5 Working and Block diagram of AC signal conditioning and DC signal conditioning 4.6 Working of chopper stabilized	8

	amplifier. 7. Analyze Working of chopper stabilized amplifier.	amplifier	
5 Oscilloscope	1. Draws block diagram and working principle of CRO. 2. Compare Dual beam and dual trace CRO. 3. Describe front panel controls of CRO. 4. List applications of CRO. 5. Draws block diagram and working principle of Digital Storage oscilloscope. 6. State the specifications of oscilloscope. 7. Calculate frequency and phase using Lissajous pattern.	5.1 constructional detail and working of Cathode ray tube (CRT) 5.2 Functional block diagram and working principle of CRO 5.3 Vertical deflection system, Horizontal deflection system. 5.4 Dual beam and dual trace CRO 5.5 front panel controls of CRO 5.6 applications of CRO 5.7 Measurement of frequency, phase using Lissajous pattern using CRO 5.8 Block diagram of Digital Storage oscilloscope, working and its controls. 5.9 Specifications of oscilloscope	10
6 Recorders And Digital Instruments	1. Draw block diagram and working principle of recorder. 2. Describe working of Logic analyzer. 3. Describe working of spectrum analyzer. 4. Describe block diagram of Virtual Instrumentation. 5. Analyze function of Digital Frequency Counter.	6.1 Principle, Working and block diagram of -strip chart recorder, Logic analyzer, spectrum analyzer. 6.2 Digital measuring instrument - advantages of Digital instrument. 6.3 Digital Voltmeter- Ramp type, Dual slope, Integrating type 6.4 Digital Frequency Counter, Digital Multimeter 6.5 Virtual Instrumentation –Concept of Virtual Instrumentation, general block diagram and architecture of a virtual instrument, Historical perspective, Advantages & disadvantages, overview of LAB view.	6
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Measure displacement using LVDT	Transducers	2
2	Measure the temperature by using thermistor.		2
3	Measure the temperature by using thermocouple.		2
4	Measure angular displacement using capacitive transducer.		2
5	Measure angular displacement using RVDT.		2
6	Measure unknown resistance using Wheatstone bridge.	Discrete Component Measurement	2
7	Measure the values of inductance, capacitance and resistance using LCR meter.		2
8	Operate front panel controls of CRO.	Oscilloscope	2
9	Operate front panel controls of digital storage oscilloscope		2
10	Measure frequency by Lissajous pattern method using CRO.		2
11	Measure Phase difference between two signals by Lissajous pattern method using CRO.		2
12	Identify and measure parameters of waveforms generated from function generator on storage oscilloscope.		2
13	Measure unknown frequency using frequency counter.		2
14	Test different component using CRO.		2
15	Measure the frequency component of AM wave using spectrum analyzer.	Recorders And Digital Instruments	2
Skill Assessment			2
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Instrumentation	02(00)	08(00)	00(06)	10(06)
02	Transducers	06(04)	08(08)	06(00)	20(12)
03	Discrete Component Measurement	02(00)	06(04)	00(00)	08(04)
04	Data Processing And Signal Conditioning	02(00)	04(00)	06(06)	12(06)
05	Oscilloscope	00(02)	04(00)	06(04)	10(06)
06	Recorders And Digital Instruments	02(02)	04(04)	04(00)	10(06)
	TOTAL	14(08)	34 (16)	22(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	2	R	2	3	R	2	4	R	2	6	R	2	5	R	2	5/7
	6	R	2																
02	1	U	4	1	U	4	2	R	4	2	U	4	2	R	4				3/5
03	2	U	4	2	U	4	4	U	4	2	U	4	3	U	4				3/5
04	5	U	4	6	U	4	6	A	4	5	A	4	6	U	4				3/5
05	2	A	6	3	U	6	1	A	6										2/3
06	4	A	6	5	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 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 (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	-	-
4	-	3	2	2	-	-	2	2	-	3	2	2
5	-	3	2	2	-	-	2	2	-	3	2	2
6	-	3	2	2	-	-	2	2	-	3	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.	A Course in Electrical and Electronic Measurements & Instrumentation	A.K.Sawhney, Dhanpat Rai Publications, 2005	9788177000160, 8177000160
2.	Electronics Instrumentation	H.K. Kalsi ,Publication- Tata McGraw-Hill,2004	0070583706, 9780070583702
3.	Modern Electronic Instrumentation & Measurement Techniques.	A. D. Helfrick W. D. Cooper, PHI Learning Pvt. Ltd.,2009	0135932947, 9780135932940
4.	Transducer and Display Systems :	B.S.Sonde. Tata McGrawHill,1992	0070966133, 9780070966130

❖ **E-REFERENCE**

- <http://www.electricalengineeringinfo.com/2016/03/static-characteristics-and-dynamic-characteristics-of-electrical-measuring-instruments.html>
- <http://www.electrical4u.com/transducer-types-of-transducer/> , assessed on 13th October, 2016
- <http://www.electrical4u.com/digital-voltmeters-working-principle-of-digital-voltmeter/> , assessed on 13th October, 2016

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

1. Digital Multi-meter 3.5 digit with R , V, I measurements, diode and BJT testing
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based
3. Bandwidth 20 MHz/30 Mhz
4. Function Generator 1 MHz , sine, square, triangular, ramp and pulse generator
Frequency range 0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
5. Regulated Power Supply 0- 30 Volt, 2 A with digital display

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
2.	Ms. P. F. Dorlikar	Lecturer in Electronics	Government Polytechnic, Nagpur.
3.	Mrs. H. R. Bhusari	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
4.	Mr. D. A. Brahmanekar	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
5.	Mr. Sandip V Darwhekar	Director	Beta Computronics Pvt Ltd , Nagpur
6.	Mrs. Gajala 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 ELECTRONICS & TELECOMM. ENGG
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC408E ^S
COURSE TITLE	: COMMUNICATION SYSTEMS
PREREQUISITE	: EC403E
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 (External)
PT. :	01 HR

❖ RATIONALE:

Electronics communication uses different media to transfer message from source to destination. Depending upon the medium used the types of signal processing and associated components differ. This course deals with different communication systems used in various applications like pulse communication, telephony, Radar, satellite communication, messaging systems.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify the needs of different communication technique.
2. Apply knowledge of wired and wireless communication system for information transfer.
3. Analyze the signal processing in different electronics components and communication system.
4. Modulate and demodulate information signal by various pulse modulation, and PCM.
5. Measure the different parameter related to microwave components.
6. Transfer the voice, video, data signal through different electronics communications systems by establishing communication link.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Pulse Communication Systems	- Define different types of pulse modulations and related theorem. - Describe the concept of various pulse modulation techniques. - Identify the various stages in generation of pulse modulation. - Describe various pulse modulation techniques. - Describe various stages in detection of various pulse modulations. - State the need of pulse code modulation. - Define Pulse Code Modulation. - Describe the different stages in PCM transmission and reception - Compare the different types of pulse modulation. - Describe the concept of TDM and FDM.	1.1 Classification of pulse modulation. 1.2 Pulse amplitude modulation (PAM) Waveforms, Sampling Theorem, Nyquist Criterion Circuit diagram of PAM modulator Circuit diagram of PAM Demodulator. 1.3 Pulse width modulation (PWM)- Waveforms, Circuit diagram of PWM modulator, Circuit diagram of PWM Demodulator. 1.4 Pulse position modulation (PPM) - 1 Waveforms, Circuit diagram of PPM modulator, Circuit diagram of PPM Demodulator. 1.5 Pulse code modulation (PCM) - quantization, quantization error, Waveforms (PCM), Block diagram of PCM transmitter, Block diagram of PCM receiver, Companding. 1.6 Comparison of pulse systems, 1.7 Concepts of Time division multiplexing (TDM) & Frequency division Multiplexing (FDM).	8
2. Telephony	- Define subscriber loop. - State the function of telephone set. - Describe the function of components of standard telephone set, electronics telephone set. - Analyze steps involved in setting telephone call. - Define various call progress tones and signals in telephony. - State the functions of various call progress tones and signals. - Execute the function of cordless telephone system. - Define Caller ID and state its function. - Define digital switching system and explain its types - Describe different terms in digital switching system. - Describe the different	2.1 Subscriber Loop 2.2 Functions of the telephone set 2.3 Functional block diagram of a standard telephone set 2.4 Steps involved in local telephone call procedures 2.5 Call progress tones and signals- Dial tone, Dual tone multifrequency, Multifrequency, Dial pulses, Exchange busy, Equipment busy, Ringing, Ring back, Receiver on / off hook. 2.6 Cordless Telephone system 2.7 Caller ID 2.8 Block diagram of electronic Telephone set 2.9 Digital Switching System. - Introduction, Classification of switching system. 2.10 Telecommunication network – trunks, subscriber lines, Basic of switching system. - Inlets, outlets symmetric network, folded network, blocking network, non blocking	12

	type's telephone networks. 12. Describe elements of switching system like SPC, enhanced services, telephone network components, subscriber loop system. (MDF, MF, FP, BF, DP, DC, DW) 13. Analyse switching Hierarchy in routing the call. 14. Describe the numbering plan in telephone system	Network. 2.11 Elements of Switching system- SPC (Stored program control), Centralize SPC, Distributed SPC, Enhanced services 2.12 Telephone Network-1 Subscribers loop system – MDF, MF, FP, BF, DP, DC, DW 2.13 Switching Hierarchy routing. 2.14 Numbering plan- Telephone number	
3. Radar Systems	1. Define the basic principle of RADAR. 2. Derive the RADAR range equation. 3. State the factors affecting maximum RADAR range 4. Describe pulse RADAR system. 5. State the factors governing pulse characteristics. 6. Identify antenna scanning and antenna tracking. 7. Distinguish the different Radar antenna scanning methods. 8. Describe the antenna tracking methods 9. Differentiate between antenna scanning and antenna tracking. 10. State the advantages of mono pulse tracking. 11. Describe different types of Radar display methods 12. State the types pulse radar systems and state their concept. 13. Identify the necessity of MTI. 14. Describe working of MTI Radar. 15. State the terms, Delay line, Blind speed, Radar Beacons. 16. Define Doppler effect, Doppler shift. 17. Identify function of different component in CW Doppler Radar. 18. State advantages,	3.1 Basic Principle of Radar 3.2 Derivation of Radar range Equation (standard), Factors affecting the maximum Radar range. 3.3 Pulsed Radar System - Factors governing pulse characteristics 3.4 Radar antenna scanning methods- Horizontal, Nodding, Helical, Spiral. 3.5 Radar antenna tracking methods- Lobe switching, Conical scanning, Monopulse tracking. Its advantages. 3.6 Radar display methods- A-scope, Plan-Position Indicator 3.7 Types of pulsed radar systems- Search radar systems (only concept), Tracking radar systems (only concept) 3.8 Moving Target Indication (MTI) radar- Block diagram, Operation of MTI radar, Delay lines, Blind speed, Radar Beacons, 3.9 CW Doppler Radar - Doppler effect, Doppler shift 3.10 Simple CW Doppler radar, CW Doppler radar with IF amplification, Advantages, applications & limitation of CW Doppler radar	12

	applications and limitations of CW Doppler radar.		
4. Satellite Communication	1.State Kepler's Laws 2. Define satellite orbit and explain orbital patterns. 3. Explain satellite orbital terms. 4. State Geosynchronous satellite and its requirement. 5Calculate satellite orbital velocity, round trip time delay. 6. Describe the Clarke orbit. 7. State the advantages and disadvantages of Geosynchronous satellite. 8. Describe the Antenna Look Angles. 9. Classify the satellites. 10. Identify frequency band allocation in satellite services. 10State antenna radiation patterns related terms. 11. Classify the antenna radiation patterns. 12.Illustrate the function of satellite system link models 13. State the requirement of satellite link models. 14. Describe inter satellite link. 15. Describe concept of power subsystem in satellite, altitude and orbit control system. 16. Draw functional diagram of telemetry tracking and command subsystem of satellite.	4.1Introduction of Satellites communication 4.2 Kepler's Laws 4.3Satellite Orbits- Satellite orbital patterns, Satellite orbital terms: Apogee , Perigee , Major axis , Minor axis, Angle of inclination , Ascending node , Descending node , Line of nodes , Prograde orbit ,Retrograde orbit 4.4Geosynchronous Satellites – requirements, Geosynchronous Satellite orbital velocity, Round trip time delay of Geosynchronous Satellite., 5.5Clarke orbit,its requirements. 5.6 Advantages & disadvantages of Geosynchronous Satellite. 4.5 Antenna Look Angles- Angle of elevation, Azimuth angle 4.6 Satellite Classifications based upon orientation- Spinner, Three axis stabilizer 4.7 Satellite Frequency Allocation 4.8 Satellite Antenna Radiation Patterns- Footprints , Spot & zonal beams, Earth global beams 4.9 Satellite system link model- Satellite uplink model, Satellite transponder,Satellite downlink model, Inter- satellite link 4.10 Types of Satellite subsystems- Power subsystem(only concept),Altitude & Orbit Control System,(only concept), 4.11 Telemetry, tracking & Command subsystem (Block diagram) 4.12 Classify satellite based on applications.	14
5. Wave Guide and Microwave Components	1. Define wave guide. 2. Identify the band designation in microwave spectrum. 3. Compare wave guide with transmission line. 4. Describe the propagation of wave through rectangular wave guide. 5. Plot the field pattern of dominant mode (lower) of rectangular wave guide. 6.State different terms related to propagation of	5.1 Wave guide-Microwave frequency spectrum and band designation, Comparison of wave guide with transmission line. 5.2Rectangular waveguides: Propagation of waves through rectangular wave guide 5.4 Reflection of waves from a conducting plane- Basic behavior, dominant mode at the conducting surface. Dominant mode of operation, plane waves at conducting surface, parallel and normal wavelength, phase velocity. 5.5The parallel plane waveguide- cut off wavelength, cut off frequency, group	14

	rectangular wave guide 7 Analyse the different modes in rectangular wave guide and field pattern. 8. State the concept related to behavior and field pattern for dominant mode in circular wave guide. 9. State advantages and applications of circular wave guide. 10. Sketch construction of different wave guide components. 11. Describe working of different wave guide components. 12. State the applications of various wave guide components. 13. Sketch and explain the construction of different microwave component. 14 State the applications of different microwave component.	and phase velocity.(Simple numerical) 5.6. Rectangular waveguide modes- TEM/TE/TM wave destination, TE&TM Modes field pattern. 5.7 Waveguide components-Construction, working principle and application of: H-plane Tee, E-plane Tee, E-Hplane Tee. Multihole directional coupler, wave guide bends, corners, Faraday rotational isolator, Isolator with twist, Faraday circulator. 5.8 Microwave Components-Construction, working principle and applications of: Multicavity klystron amplifier, Reflex Klystron amplifier, Travelling wave tube, Magnetron. 5.9 Construction working principle and applications of: Tunnel diodes, Gunn diode, PIN diode.	
6. Messaging Systems	1. Define FAX 2. Describe scanning used in FAX system. 3. Draw the functional diagram of FAX transmission and reception. 4. Describe the function of different component in FAX system.	6.1 Introduction to Facsimile/Fax system 6.2 Document scanning using CCD 6.3 LED / CCD Scanner mechanism in a fax machine (Block diagram) 6.4 Block diagram of fax trans receiver	04
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	i) Connect the pulse sampling circuit and observe sampled signal for different sampling frequency. ii) Reconstruct the original information signal from samples.	Pulse Communication Systems	2
2	Modulate information signal for PAM and demodulate to recover the original information signal.		2
3	Modulate information signal for PWM and demodulate to recover the original information signal.		2
4.	Multiplex the given information signal in TDM, transmit and de-multiplex at receiver end to recover original signals.		2
5.	Obtain the PCM code for given information signal and detect at receiver end.		2
6.	Identify the various components in electronics telephone set and test for their functions.	Telephony	2
7.	Set the model of MTI radar for demonstration and observe the detection of object in range.	Radar Systems	2
8	Identify the various components in satellite communication model and test their functions.	Satellite Communication	2
9	Connect the satellite system model to set satellite communication link and observe the communication established to transfer audio, video, signal..		2
10	Connect the satellite system model to set direct link and observe the communication established to transfer audio, video, signal		2
11	Measure the output frequency of Reflex Klystron and .Sketch the waveforms.	Wave Guide and Microwave Components	2
12	Connect the set up E-plane Tee and calculate its S-parameters.		2
13	Measure the power losses in wave guide bend.		2
15	Assemble the wave guide coupler to act as duplexer. Test performance.		2
16	Identify the component of FAX machine and test the functioning of fax machine.	Messaging Systems	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	Pulse Communication Systems	04(00)	04(04)	00(00)	08(04)
02	Telephony	06(00)	00(06)	06(00)	12(06)
03	Radar Systems	04(00)	10(00)	00(08)	14(08)
04	Satellite Communication	02(04)	08(06)	06(00)	16(10)
05	Wave Guide and Microwave Components	02(06)	08(04)	06(00)	16(10)
06	Messaging Systems	00(02)	04(00)	00(00)	04(02)
	Total	18(12)	34(20)	18 (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	1	R	2	2	R	2	4	R	2	5	R	2	5	R	2	5/7
	6	R	2																
02	1	U	4	2	R	4	3	R	4	1	U	4	4	R	4				3/5
03	3	U	4	4	U	4	4	U	4	3	A	4	3	A	4				3/5
04	5	U	4	5	U	4	6	U	4	5	U	4	5	R	4				3/5
05	2	A	6	4	A	6	2	U	6										2/3
06	3	U	6	5	A	6	4	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 practical set up, selection of equipment's. writing procedure etc.	20
2	Performance	10
3	Calculation, Result, Drawing Waveforms /Graph	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	2	-	-	2	2	-	3	2	3
5	-	3	2	2	-	-	2	2	-	3	2	3
6	-	3	2	2	-	-	2	2	-	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.	Advanced Electronic Communication systems	Wayne Tomasi, Prentice Hall of India, Sixth Edition 2004	81-203-2497-8
2.	Electronic Communication systems	Kennedy, Davis, Tata McGraw-Hill, Fourth Edition, 1999	0-07-463682-0
3.	Communication Systems	R. P. Singh, S. D. Sapre, Tata McGraw-Hill, First Edition 1995	0-07-460339-6
4.	Telecommunication Switching systems and Networks	T. Viswanathan, Prentice Hall of India, First Edition, 2005	81-203-0713-5
5.	Satellite Communication	D. C. Agarwal, Khanna publishers, Fifth Edition, 2009	81-7409-144-0
6	Satellite Communication	Pratt, Bostian, Allnutt, Wiley Second Edition, 2006	81-265-0833-7
7	Satellite Communication	Robert Gagliardi, CBS Publication, First Edition, 2004	81-239-0919-5

8	Communication Electronics	Louis E Frenzel, Tata McGraw-Hill, Third Edition, 2002	00-704-8398-1
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❖ **E-REFERENCES:**

- <http://www.nptelvideos.in/2012/12/digital-communication.html> assessed on 28th August, 2016
- <http://www.engineersgarage.com/tutorials/circuit-design-pulse-amplitude-demodulation>, assessed on 29th August, 2016
- http://www.nptel.ac.in/Clarify_doubts.php?subjectId=101108056, assessed on 29th August, 2016

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

1. Digital Multi-meter 3 ¼ digit display
2. Cathode ray oscilloscope- 0 to 50 MHz
3. Digital Storage Oscilloscope-0 to 100MHz
4. Function Generator-Frequency 10 Hz to 20 MHz.

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

S.N.	Name	Designation	Institute / Industry
1.	Mr.D. A.Brahmankar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mrs.U.M.Ramteke	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mrs.K.G.Giri	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mr.Sandip V. Darwhekar	Director	Beta Computronics Pvt.Ltd. Nagpur
5.	Mrs.Gazzala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur.
6.	Mr.S.M.Kale	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Gadchiroli.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC409E^{\$}

COURSE TITLE : WIRELESS COMMUNICATION

PREREQUISITE : EC403E

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 (External)

PT. : 01 HR

❖ **RATIONALE:**

The glorious 21st century marks the wireless communication industry by order of magnitude. The recent exponential growth in wireless communication needs more skilled technicians for operations, maintenance and servicing of wireless communication system. This subject is classified under professional group and it is based on communication theory, which gives theoretical as well as practical knowledge of different wireless systems. It covers digital cellular mobile system such as GSM, IS-95 standards, WLL, call processing and basic of mobile communication system.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply the fundamental principles of wireless and wired communication to design mobile communication systems.
2. Use the concept of wireless communication for different applications.
3. Analyze various problems with cellular system.
4. Identify different Faults occurred due to network in mobile unit.
5. Measure different values (voltage) in mobile system.
6. Prepare Visit Report.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction To Wireless Communication System	1. Describe the evolution of the mobile system. 2. Define base station, control station, forward channel, reverse channel. 3. List different standards 4. State the need of 800MHz 5. State the Role of engineers in planning of cellular system.	1.1 Introduction to wireless communications. 1.2 Evolution of mobile radio communication system. 1.3 Major Mobile radio Standards in world (AMPS, N-AMPS,IS-95,GSM) 1.4 Examples of Wireless communication system 1.5 Wireless communication system definitions :- base Station, Control Channel, forward channel, reverse channel , Mobile Station, Mobile Switching center, etc. 1.6 Need of 800MHz frequency. 1.7 Trunking efficiency, Trunking and grade of service, performance criteria, uniqueness of mobile radio environment. 1.8 Marketing image of hexagonal shaped cells 1.9 Planning cellular system, Engineers role in planning of cellular system	12
2. Cellular Concepts	1. State the problem with cellular system. 2. Describe cellular mobile radio system. 3. Understand the concept of frequency reuse. 4. Compare different interference in cellular system. 5. Describe various techniques to improve capacity in cellular system. 6. Justify how Splitting of cell increase the capacity of cellular syatem.	2.1 Limitations of conventional mobile telephone system, Problems with Cellular System 2.2 A basic Cellular System, Operation of Cellular system 2.3 Cellular Telephone System, describe cellular telephone call is made 2.4 Concept of frequency reuse channel, frequency reuse schemes, frequency reuse distance, number of customer in the system. 2.5 Interference and system capacity, Co-Channel interference, adjacent channel	12

		interference, interference reduction factor. 2.6 Improving coverage and capacity in cellular system:- cell splitting, Permanent Splitting and Dynamic Splitting, Sectoring, Microcell Zone concept.	
3. Handoff And Dropped Calls	1. State the need of handoff. 2. Describe forced handoff. 3. List advantages of delayed handoff. 4. Compare different handoff mechanisms. 5. Describe intersystem handoff. 6. Define Dropped Call rate. 7. Identify the missing element from the diagram of MAHO	3.1 Need of handoff, types of handoff. 3.2 Initiation of a Handoff. 3.3 Handoff Strategies, Prioritizing Handoffs, Practical Handoff considerations 3.4 Delaying a handoff, advantage of Delayed handoff, Forced Handoff, Controlling a Handoff, Creating a Handoff. 3.5 Queuing of handoff, Power Difference handoff. 3.6 Mobile Assisted Handoff (MAHO), Cell-Site Handoff only 3.7 Intersystem handoff 3.8 Introduction to Dropped call rate	10
4. Cell-Site Antenna And Mobile Antenna	1. Describe antenna used for coverage purpose. 2. Describe various umbrella pattern antennas. 3. State different interference reduction antennas. 4. Identify problems with cell site 5. List different mobile antennas. 6. Describe Mobile antenna	4.1 Antennas at cell site. 4.2 For Coverage use-Omni directional antennas, directional, location antennas, setup channel antennas, space diversity antennas 4.3 Umbrella Pattern Antennas:- Normal, High Gain, Broadband Umbrella Pattern Antennas 4.4 Unique situation of cell site antennas:-antenna pattern in free space and in mobile environment, Minimum separation in cell site receiving antennas 4.5 Regular check of cell site antennas, choosing an antenna site 4.6 Mobile antennas:-Roof Mounted, Glass mounted, Mobile High-Gain antennas.	10

		4.7 Micro strip Antenna	
5.Mobile Unit	1. Draw block diagram of mobile unit. 2. Draw block diagram of frequency synthesizer. 3. Describe operation of transmitter and receiver. 4. State importance of SIM 5. List features of SIM 6. Identify the missing block from the diagram of Frequency Synthesizer	5.1 Block diagram and operation of mobile unit 5.2 Block diagram of Frequency synthesizer 5.3 Block diagram and operation of transmitter, receiver, logic unit, control unit and handset 5.4 Subscriber's Identification Module(SIM) 5.5 SIM features	06
6.Modern Wireless Communication System	1. Describe GSM Architecture. 2. State features of GSM. 3. Describe CDMA digital cellular standard. 4. Compare GSM and CDMA standard. 5. Describe WLL 6. List features of 4G 7. Describe Zigbee, Wifi, wiMAX	6.1 Global System for mobile (GSM), GSM System Architecture, GSM Services and features, GSM radio subsystem, GSM channel types, frame structure for GSM, signal processing in GSM. 6.2 Features of Code Division multiple Access(CDMA) 6.3 Second Generation 2G, 2.5G, 2.5G TDMA standards. 6.4 IS-95B for 2.5G CDMA. 6.5 Third Generation(3G),3G-W-CDMA (UMTS),3G CDMA 2000, 3G TD-SCDMA 6.6 Wireless Local Loop(WLL) and Local Multipoint Distribution(LMDS) 6.7 Wireless local area networks(WLANs) 6.8 Bluetooth and personal area network(PANs) 6.9 ZigBee, Wi-Fi, WiMAX. 6.10 Introduction to 4G, Features and Specification of 4G	14
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Carry out general fault finding procedure in GSM mobile handset	Introduction to Wireless comm. system	2
2	Use the Mobile Kit to Observe and Analyze the Mobile is powered ON at the alarm set Time	Introduction to Wireless comm. system	2
3	Measure the value of power supply used in mobile system	Cellular Mobile Radio system	2
4	Use the CRO to observe the audio signal in mobile system using mobile kit	Cellular Mobile Radio system	2
5	Measure the voltage at SIM supply and at other pins of SIM using multimeter	Cellular Mobile Radio system	2
6	Connect the CRO to observe the SIM clock and measure the voltage at SIM Clock using multimeter	Mobile unit	2
7	Verify and analyze the intensity in hardware control of mobile system	Mobile Unit	2
8	Identify the fault inserted in keypad of mobile system	Handoff and Dropped calls	2
9	Identify the fault in LCD in mobile system.	Handoff and Dropped calls	2
10	Observe and analyze the charging phenomena with fault insertion in mobile system	Mobile Unit	2
11	Prepare a report on Industrial visit to mobile CDMA company or GSM Company OR Prepare a report on CDMA and GSM mobile by using video CD	Modern wireless comm. system	4
12	Prepare a report on Industrial visit to mobile tower and base station or Prepare a report on mobile tower and base station by observing Video CD	Modern wireless comm. system	4
13	Prepare report on features , services provided to mobile by different company		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	Introduction to Wireless communication system	04(04)	08(04)	00(00)	12(08)
02	Cellular Concepts	02(00)	04(04)	06(00)	12(04)
03	Handoff and dropped calls	04 (02)	00(04)	06(00)	10(06)
04	Cell site antenna and mobile antenna	02(02)	08(04)	00(00)	10(06)
05	Mobile unit	04(00)	06(00)	00(06)	10(06)
06	Digital cellular system and modern wireless comm.	06(04)	10(06)	00(00)	16(10)
	Total	22(12)	36(22)	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	2	R	2	4	R	2	6	R	2	6	R	2	6	R	2	3	R	2	5/7
	4	R	2																
02	1	R	4	1	U	4	1	U	4	1	R	4	1	U	4				3/5
03	2	U	4	3	R	4	4	U	4	2	U	4	3	U	4				3/5
04	4	U	4	5	R	4	6	U	4	6	R	4	4	U	4				3/5
05	2	A	6	3	A	6	5	A	6										2/3
06	5	U	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	Drawing circuit diagram, writing observation table ,draw waveforms and writing procedure etc.	10
2	Performance of the practical	20
3	Taking observations ,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
4	-	3	3	2	-	-	3	2	-	3	3	3
5	-	3	3	2	-	-	3	2	-	3	3	3
6	-	3	3	2	-	-	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.	Wireless Communication	Theodore S. Rappaport, Prentice Hall Of india, 5 th Edition 2011	9788131731864
3.	Mobile Cellular Telecommunication	William C. Y. Lee, Tata McGraw Hill, 2 nd Edition 2006	9780070635999
4.	Wireless Communication	Andreas Molisch, Wiley, Student 2 nd edition	9780470741863
5.	Mobile and Personal Communication System and Services	Raj Pandya, Prentice hall	9780780347083

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/117103063> , assessed on 25th September, 2016
- <http://www.electronicsforu.com> , assessed on 25th September, 2016
- <https://www.youtube.com/watch?v=w8Dq8bITmSA> , assessed on 25th September, 2016

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

1. GSM Mobile Unit
2. Digital Multi-meter
3. Cathode Ray Oscilloscope (0-50 MHZ)
4. Function Generator

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	HOD, Electronics and telecommunications	Government Polytechnic, Nagpur.
2.	Mr. D. A. Brahmanekar	Lecturer.	Government Polytechnic, Nagpur.
3.	Mrs. U. P. Potdar	Lecturer.	Government Polytechnic, Nagpur.
4.	Mr. Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
5.	Mrs. Gazzala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur
6.	Mr. S. M. Kale	Lecturer, Electronics and Telecommunication	Government Polytechnic, Gadchiroli

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC410E^s

COURSE TITLE : DIGITAL COMMUNICATION

PREREQUISITE : EC403E

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:

Our aim is to achieve the vision of Digital India, where every Indian is digitally empowered and every information is digitally available. The role of Electronics and Telecommunication student is important in perceiving Digital India concept. In order to meet the prerequisites, this course focuses on fundamental concepts of digital modulation, digital transmission, multiplexing, data communication circuits, basic networking fundamentals such as error control, protocols that are pillars of Digital Communication. Study of Digital Communication for Electronics and Telecommunication students offers an opportunity to transform themselves into digital enterprises.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze the different digital communication system.
2. Decide the digital modulation technique, data transfer technique for specific application
3. Develop the ability to describe working principle of various digital transmission, digital modulation, multiplexing, channel encoding, line encoding, data communication, data link protocols.
4. Connect and test various digital communication circuits
5. Draw waveforms, phasor diagram and constellation diagram of different digital modulation and demodulation.
6. Test serial/parallel, Synchronous/Asynchronous data transmission/protocols.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Digital transmission	1 Draw Block diagram of digital communication system 2. State the Advantages and Disadvantages of digital communication 3 State Sampling theorem 4. Illustrate the concept of Nyquist rate ,aliasing 5. Describe Quantization Process 6. Draw and describe block diagram of analog and digital companding 7. Draw and describe block diagram of PCM, DPCM, DM, ADM transmitter and receiver 8. Compare various modulation techniques 9. Illustrate the concept of ISI 10. Draw and describe Eye diagram	1.1 Block diagram of digital communication system 1.2 Advantages and Disadvantages of digital communication 1.3 Sampling theorem ,Nyquist rate ,aliasing 1.4 Quantization, quantization error 1.5 Companding-Block diagram of analog ,digital companding 1.6 Block diagram and operating principles of PCM,DPCM, DM, ADM transmitter and receiver 1.7 Comparison between various (above) modulation techniques 1.8 Inter symbol interference 1.9 Eye diagram	10
2. Digital modulation	1. Define and draw waveforms of basic digital modulation techniques 2. Draw Phaser diagram / constellation diagram of various digital modulation techniques 3. State Advantages/disadvantages of various digital modulation techniques 4. State Band width requirement of various digital modulation techniques 5. Compare various digital modulation techniques 6. Draw and describe block diagram of transmitter and receiver of various digital modulation techniques 7. Draw and describe block diagram of different methods of carrier recovery 8. Illustrate the concept of Clock	2.1 Basic Digital Modulation Techniques: - Block diagram ,working and waveforms of Amplitude Shift Keying(ASK) ,Frequency shift keying(FSK) Binary Phase shift keying(BPSK) transmitter and receiver , - Phaser diagram , constellation diagram and Bandwidth considerations of BPSK 2.2 Quaternary Phase Shift Keying - Block diagram of QPSK, Offset QPSK (OQPSK),8-PSK transmitter and receiver - Waveforms , Phaser diagram constellation diagram ,Bandwidth considerations of QPSK , 8-PSK 2.3 Quadrature Amplitude Modulation	10

	recovery	- Block diagram of 16-QAM transmitter ,receiver - Phaser diagram , constellation diagram of 16-QAM 2.4 Comparison of digital modulation techniques (No mathematical approach) 2.5 Carrier recovery –block diagram of squaring loop, costas loop , 2.6 Clock recovery	
3.Information theory and coding	1. Define Amount of information ,Entropy Information Rate 2. State Shannon's theorems of channel capacity 3. Analyze channel noise and its effects 4. Describe Huffman coding 5. Solve numerical on Amount of information ,Entropy ,Information Rate, Huffman coding and Shannon's theorems of channel capacity 6. Illustrate the concept of Baudot code, ASCII code 7. Illustrate factors for selecting line encoding format 8. Draw various line encoding formats for given digital inputs 9. Illustrate the various methods of error detection 10. Describe various Error correction techniques 11. Solve numerical on CRC and Hamming codes	3.1 Information theory - Amount of information ,Entropy ,Information Rate , - Huffman coding, - Shannon's theorems of channel capacity - Channel noise and its effects (Numerical on 3.1) 3.2 Baudot code, ASCII code , 3.3 Digital carrier line encoding- - Factors for selecting line coding format - waveforms of Unipolar RZ, NRZ ,Polar RZ, NRZ, - Waveforms of Biphase M ,Biphase L, Biphase S, Differential Manchester, 3.4 Channel encoding - Error detection :Vertical redundancy check(VRC) , Longitudinal redundancy check (LRC) ,Checksum , Cyclic redundancy Checking (CRC) - Error correction : Retransmission , Forward error correction-Hamming Codes	10
4 Multiplexing	1. State Need and Types of multiplexing 2. Draw and describe block diagram of two channel PCM-TDM / T1 digital carrier system 3. Illustrate the concept of D-type channel Banks , Superframe	4.1 Need and Types of multiplexing 4.2 TDM-Block diagram of single channel (DS-0-level) PCM transmission system 4.3 T1 digital carrier. 4.4 North American digital	08

	TDM format, Extended superframe format , fractional T carrier Service 4. Analyze / Describe T1 T2,T3 carrier systems with suitable waveforms 5. Illustrate the concept of Bit and word interleaving 6. Define Codec 7. State general operation/ features of codec/filter combo chips	Hierarchy 4.5 T1 T2,T3 carrier systems 4.6 Digital carrier frame synchronization 4.7 Bit and word interleaving 4.8 Codec: general operation/ features of codec/filter combo chips	
5.Fundamentals of Data Communication	1 List various Data communication standards 2 Define various terms of data communication 3 Describe types of Data Communications : Serial, Parallel, Synchronous, Asynchronous 4 Illustrate the concept of various transmission modes simplex, Half duplex ,Full duplex ,Full/full duplex 5 Describe the Data Terminal equipment, Data Communication Equipment 6 Draw suitable diagram to illustrate Two point ,Multipoint data communication circuit 7 Draw and describe UART transmitter ,receiver 8 Illustrate the concept of UART interface , character format, transmit and receive signal sequence , Start bit verification circuit 9 State the primary functions of USRT 10 Describe signals, pin functions, electrical equivalent circuit of RS-232 11 Define modem 12 Draw and describe Block diagram of an asynchronous FSK modem 13 State Features of MODEM 14 Draw and describe block diagram of PN sequence	5.1 Data communication standards 5.2 Basic block diagram of data communication circuit 5.3 Serial and parallel data transmission 5.4 Data communications circuit arrangements 5.5 Character Synchronization: Asynchronous serial data , synchronous serial data 5.6 Data communication hardware : Data Terminal Equipment(DTE), Data communication Equipment(DCE) 5.7 Data communication Circuits: Two point ,Multipoint data communication circuit 5.8 Line Control Unit : - UART interface , signals, pin functions, limitations, Block diagram of UART transmitter ,receiver, Start bit verification circuit - Universal Synchronous Receiver/Transmitter(USRT) 5.9 RS-232 Serial interface standard - RS-232 electrical equivalent circuit, functional description, pins ,signals - Functional block diagram of RS-232 transmit and receive circuits of asynchronous data transmission 5.10 Data communication	18

	generator/ SS communication system 15 Draw and describe block diagram of DSSS transmitter 16 Draw and describe block diagram of FHSS transmitter/receiver 17 State advantages and disadvantages of DSSS and FHSS, 18 State applications of SS system 19 Identify the mode of transmission in given diagram. 20 Analyze signal flow in RS232	Modems - Block diagram of an asynchronous FSK modem - Features of MODEM 5.11 Spread spectrum communication - Block diagram of Spread Spectrum (SS) communication System - Generation of Pseudo-Noise (PN) sequence - Block diagram of Direct sequence Spread Spectrum (DSSS) transmitter/encoder - Block diagram of Frequency Hop Spread Spectrum (FHSS) transmitter and receiver, Slow frequency Hopping and Fast frequency hopping - State advantages and disadvantages of Spread Spectrum methods - Applications of Spread Spectrum modulation	
6. Data link protocols	1 Draw diagram and describe ENQ/ACK, Poll/Select line discipline 2 Describe Character and Bit oriented Data link protocols 3 State Asynchronous Data link protocols 4 Describe the terms (BSC) , BSC polling sequences, BSC selection sequence, BSC message sequence, BSC transparency 5 Draw and describe SDLC frame format 6 Draw and analyze diagram SDLC loop operation 7 Analyze Synchronous data link protocols	6.1 Data link protocol functions: - Line discipline : ENQ/ACK, Poll/Select, - Flow control: stop and wait ,sliding window ,error control 6.2 Character and Bit oriented Data link protocols 6.3 Asynchronous Data link protocols 6.4 Synchronous Data link protocols : - Binary Synchronous communication(BSC) , - BSC polling sequences, - BSC selection sequence, - BSC message sequence, - BSC transparency 6.5 Synchronous data link control (SDLC) :SDLC frame format, SDLC loop operation	08
Total Hrs			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
01	Test the sample and hold circuit for various sampling frequencies to check the sampling theorem	Digital transmission	02
02	Check the performance of Pulse code modulator /DPCM modulator and Demodulator		02
03	Check the performance of Delta Modulator/ Adaptive Delta Modulator		04
04	Check the performance of ASK/FSK/PSK modulator and demodulator	Digital modulation	04
05	Check the performance of QPSK/ 8- QAM/16-QAM modulator and demodulator OR Test the circuit for carrier and clock recovery		04
06	Check the performance of Pulse code modulator and Demodulator for error detection and correction (Parity and hamming codes)	Information theory and coding	02
07	Test the TDM Transceiver for multiplexing two or more signals	Multiplexing	02
08	Test the line encoder circuit for various line encoding formats		02
09	Collect information and compare performance parameters of various Codec ICs for general operation/ features of codec/filter combo chips		02
10	Transfer the data using RS-232 standards/UART technique./Prepare data transfer cable using RS-232 standards	Fundamentals of Data Communication	02
11	Check the performance of bit synchronizer / carrier synchronizer / MODEMS		02
12	Collect information and compare performance parameters of Synchronous / Asynchronous Data link protocols and Prepare report	Data link protocols	02
Skill Assessment			02
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Digital transmission	04(02)	06(04)	00(00)	10(06)
02	Digital modulation	06(04)	06(04)	00(00)	12(08)
03	Information theory and coding	00(02)	04(00)	06(06)	10(08)
04	Multiplexing	02(00)	04(06)	04(00)	10(06)
05	Fundamentals of Data Communication	04(04)	10(00)	04(04)	18(08)
06	Data link protocols	02(00)	04(04)	04(00)	10(04)
	Total	18(12)	34(18)	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	2	R	2	4	R	2	5	R	2	5	R	2	6	R	2	1	R	2	5/7
	3	R	2																
02	1	R	4	2	R	4	5	R	4	2	R	4	1	U	4				3/5
03	3	A	4	6	A	4	6	U	4	6	U	4	2	U	4				3/5
04	5	A	4	4	A	4	4	U	4	5	U	4	5	A	4				3/5
05	1	U	6	2	U	6	3	A	6										2/3
06	3	U	6	5	U	6	4	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 block diagram, selection of equipment's/ Trainer kit, writing procedure etc.	10
2	Performance-Connecting Equipments/Trainer kit, Identification of different sections of given trainer kit OR Obtaining waveforms of input, output or different testing points OR Testing ,Exploring different parameters of given trainer kit	10
3	Result, Drawing Waveforms(if any),Analyzing waveforms	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	-	-	2	2	2	-	-	3	3	3
2	-	3	-	-	2	2	2	-	-	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	Electronic Communications Systems	Wayne Tomasi ,Pearson Education, Fifth Edition, 2009	978-81-317-1953-4
2	Principle of communication systems	Donald L. Schilling, Goutam Saha, Herbert Taub, Tata McGraw-Hill Education Pvt. Ltd, Fourth Edition, 2015	10: 1259029859 / 13: 9781259029851
3	Data and Computer Communication	William Stallings, Pearson Education ,EightEdition,2008	0-13-243310-9

4	Computer Networks	Andrew S. Tanenbaum/David J. Wetherall, Pearson, Fifth Edition, 2014	9789332518742
5	Digital communication	John Proakis and Masoud Salehi Digital Communications, Fifth Edition, 2007	13: 978-0072957167 10: 0072957166
6	Digital Communication	Amitabha Bhattacharya, Tata Mcgraw Hill, First Edition, 2011	13: 9780070591172 10: 0070591172/

❖ E-REFERENCES:

- http://nptel.ac.in/keyword_search_result.php?word=digital+communication, assessed on 25th October 2016
- <https://www.youtube.com/watch?v=Y4tOm5rdmtY&feature=youtu.be&dt=00h16m0s>, assessed on 25th October 2016
- <https://www.youtube.com/watch?v=ifgs0uypC78>, assessed on 25th October 2016
- <https://www.youtube.com/watch?v=ZDFJqOTbSmE>, assessed on 25th October 2016
- <https://www.youtube.com/watch?v=5BFd31sv50g>, assessed on 25th October 2016
- <http://nptel.ac.in/course.php?disciplineId=117>, assessed on 25th October 2016
- <http://nptel.ac.in/courses/106105082/38>, assessed on 25th October 2016
- https://en.wikipedia.org/wiki/Data_transmission, assessed on 25th October 2016
- <http://www.explainthatstuff.com/modems.html>, assessed on 25th October 2016
- <http://computer.howstuffworks.com/serial-port1.htm>, assessed on 25th October 2016
- <http://electronicdesign.com/communications/understanding-modern-digital-modulation-techniques>, assessed on 25th October 2016

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION

1. Spectrum analyzer, Max. 1.5 GHz Frequency Range
2. DSO-100 MHz
3. CRO – Dual trace, 20 MHz Bandwidth
4. Function Generator: Frequency Range 0.1 Hz to 1 MHz.
5. RF generator/wideband oscillator Wide Frequency Range 100 KHz to 150MHz.
6. Digital Communication Trainer System for various Modulations and Demodulations: ASK, FSK, BPSK, QPSK, 8-PSK, 16-QAM
7. Digital Communication Trainer System for PCM/ Delta/Adaptive Delta/DPCM Modulation/Transmitter and Demodulation /Receiver
8. Digital Communication Trainer System for TDM , Spread spectrum System , Modem, Serial/Parallel data Transmission

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

S.N	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
2.	Mrs. U. M. Ramteke	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
3.	Mr. D. A. Brahmanekar	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
4.	Ms. K. P. Giri	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
5.	Mrs. R. Vairagade	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
6.	Mrs. U. P. Podar	Lecturer in Electronics and Telecomm. Engineering	Government Polytechnic, Nagpur.
7.	Mr. S.V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
8.	Mrs. Gazala Ali	Head of Electronics Engineering	Anjuman Polytechnic , Nagpur
9.	Mr. S. M. Kale	Lecturer in Electronics. Engineering	Government Polytechnic, Gadchiroli

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC411E^{\$}

COURSE TITLE : AUDIO VIDEO SYSTEMS

PREREQUISITE : EC403E

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:**

The state of the art in Audio & Video systems will enable the students to comprehend, the fact, concept, working principle and its application in various types of modern electronic audio video systems. The audio HI-FI, stereophonic, PA system & video system like digital TV, HDTV, DTH, and DVD have brought about audio-video revolution in the field of home entertainment, education, training, and advertising and electronic newsgathering. Dramatic developments in solid state camera, flat panel display like plasma TV, LCD, LED display and integrated subsystems is going to affect our communication capabilities and life-style in a big way.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Select various audio systems used in home entertainment, auditorium, public places.
2. Analyze various video systems like color TV, digital TV, HDTV, DTH, Non-radiating video system
3. Identify the different signals at various stages of audio & video systems.
4. Operate various audio & video systems.
5. Trace different circuits of audio & video system
6. Assemble & test different elements of audio & video system

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Audio Fundamentals	1. State the characteristics of sound 2. Define various parameters of sound. 3. Recall sensitivity of human ear for sound 4. Illustrate the concept of Acoustic reverberation reflection & diffraction of sound waves 5. Describe the concept of acoustics of auditoriums	1.1 Pressure and intensity of sound waves, Intensity of various types of sound 1.2 Sensitivity of human ear for sound 1.3 Frequency of sound waves, overtones and timbre 1.4 Intervals, octaves, harmonics and pitch 1.5 Reflection and diffraction of sound waves 1.6 Acoustic Reverberation, necessity of reverberation 1.7 Acoustics of auditoriums	04
2 Audio Amplifiers & Systems	1. State types & Characteristics of audio amplifiers 2. Illustrate the concept of PMPO 3. Draw Circuit diagram of various Controls in audio amplifiers. 4. Describe the working principle of parametric equalizer & Graphic equalizer 5. Define fidelity & Hi-fi. 6. Draw & describe circuits of multi way speaker system 6. Draw & describe response curves of multi way speaker system 7. Define stereophony 8. Compare monophonic & stereophonic systems 9. Draw & describe Circuit diagram of stereo controls 10. Draw & describe block diagram of Hi-Fi stereo reproducing system & surround sound system 11. State need & Requirements of PA system	2.1 Audio amplifiers 2.2 Types & Characteristics of audio amplifiers, Peak Music Power Output (PMPO), Controls in audio amplifiers Circuit diagram of Microphone gain control, volume control & tone controls Special types of tone controls Parametric Equalizer & Graphic Equalizer (Only concept no circuit diagram) 2.3 Hi-Fi system Definition of Fidelity, High Fidelity Requirements of Hi-Fi systems. Various causes affecting fidelity Multiway speaker system, Crossover networks – Basic circuits & response curves of two way & three way speaker system 2.4 Stereophony: Definition of stereophony Difference between monophonic & stereophonic systems Block diagram of Hi-Fi stereo reproducing system & surround sound system Stereo controls- Circuit diagram of Balance control & Loudness control 2.5 Public Address system	10

	12. Identify the given circuit diagram / Block diagram 13. Analyze speaker arrangement for given PA system 14. Analyze the given block diagram for missing block or by replacing one block with another block for system performance	Block diagram , Need ,Requirements & applications of PA system PA system for public meeting ,large capacity auditorium	
3. TV Fundamentals	1. Define various terms of basics of TV 2. Describe the concept of scanning methods 3. Define various terms of scanning ,resolution ,composite video signal 4. Draw waveforms of Composite Video Signal & its various parts 5. Describe the concept of Positive & negative modulation 6. State advantages & disadvantages of Positive & negative modulation 7. State types of TV standards, CC IR B standards 8. Draw& describe basic block diagram of monochrome TV transmitter & receiver 9. Describe the working principle of CCD camera 10. State advantages of solid state TV camera	3.1 Introduction of TV Aspect ratio, flicker , brightness, tonal gradation and contrast Scanning :Need of scanning, Saw tooth currents for scanning, Progressive scanning, Interlaced scanning ,Frame ,Field and line frequencies Resolution : Vertical resolution, Horizontal resolution, Bandwidth of video signal, 3.2 Composite Video Signal : Synchronization & blanking ,Positive & Negative polarities of CVS ,Voltage levels in CVS with waveform, Horizontal Blanking pulse, Horizontal sync pulse details Vertical Blanking pulse, Vertical sync pulse details-Serrations pre-equalizing, post- equalizing pulses 3.3 Modulation requirements for TV Positive & negative modulation Advantages & disadvantages of Negative modulation 3.4 Need of television standards, Types of TV standards, CC IR B standards, 3.5 Basic block diagram of monochrome TV transmitter & receiver, 3.6 TV Camera Solid State camera based on CCD Advantages of Solid State TV camera	12
4.Colour TV systems	1. Define various terms of characteristics of colour & colour theory 2. Draw& describe basic	4.1 Characteristics of colour : Hue, Saturation, Luminance, Resolution & bandwidth of colour Colour theory :primary &	14

	block diagram of colour TV transmitter & receiver - Describe the working principle of colour TV transmitter & receiver - Describe the concept of Compatibility of colour and B/W TV - Draw & describe the block diagram of Generation of luminance(Y)& chrominance signal(U & V) - Draw block diagram of generation of luminance & chrominance signal - Illustrate why (G-Y) is not transmitted. - Draw waveforms of CCVS - Illustrate the concept of frequency interleaving technique. - Illustrate the concept of VSB with frequency spectrum - Describe the working principle of PAL colour TV system - Draw block diagram of PAL transmitter/ receiver , PAL encoder/decoder - State differences & Similarities between NTSC system & PAL system - Sketch the TV transmitting & receiving antenna - Draw constructional diagram of PIL picture tube - Describe the working principle of plasma , LCD , LED display - Identify missing block in the given block diagram - Analyze the given block diagram by replacing one block with another block for system performance - Analyze the constructional diagram of camera or picture tube for missing part	complementary colours, additive & subtractive Colour mixing, Grassman's law, Tristimulus values Chromaticity diagram, colour circle Basic block diagram of colour TV transmitter & Receiver - Compatibility of colour and monochrome TV signal. - Colour TV camera : Generation of luminance & chrominance signal, Transmission of colour difference signal , Weighing factors for colour difference signal Colour composite video signal Frequency interleaving technique in colour signal transmission (colour subcarrier) Vestigial Sideband transmission (VSB) - Colour TV standards, Introduction & comparison of NTSC , PAL & SECAM systems - PAL colour system Block diagram of PAL Transmitter , production of luminance (Y) & chrominance signals (U and V), PAL encoder Block diagram of PAL receiver, Simple PAL (S-PAL) colour decoder, D-PAL Decoder disadvantages of S-PAL Decoder, Automatic correction of colour error in PAL receivers Controls in PAL receiver Advantages and disadvantages of PAL system - TV Antennas : transmitter antennas – Turnstile antenna , dipole array TV receiver antennas – Yagi-Uda antenna , Log periodic antenna - Color Picture tube- PIL picture tube (working & principle only). - LCD/LED Technology: Principle and working of LCD and LED TV systems	
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5. Video Systems	1. Draw& describe block diagram of DTH system 2. State advantages & disadvantages of digital TV 3. Describe working of digital TV & HDTV 4. Draw & describe block diagram of audio transmitter/receiver of digital TV 5. Draw & describe block diagram of picture –in-picture system 6. Illustrate the concept of wide dimension HDTV 7. Draw & describe block diagram of MAC encoder/decoder 8. Draw & describe block diagram of OFDM based DVB (DVB-T)transmitter 9. State Advantages & disadvantages of OFDM – based DVB system 10. Draw & describe block diagram of ATSC HDTV broadcast transmitter based on 8VSB modulation system 11. State Advantages & disadvantages of 8VSB modulation 12. Draw & describe block diagram of CCTV, MATV , CATV 13. State channels for cable TV 14. Illustrate concept two way cable system, 15. State features of digital CATV 16. Draw & Analyze given block diagram	5.1 Satellite communication for TV : - Block diagram of TV broadcast satellite system, - Block diagram of Direct-To – Home (DTH) transponder & DTH receiver 5.2 Digital TV: - Advantages& disadvantages of digital TV - Block diagram of digital video production and reproduction ,Digital picture transmission & reception, - Block diagram of digital TV audio transmitter& receiver - Block diagram of picture –in – picture system 5.3 HDTV: - Development of HDTV, - wide dimension HDTV, - block diagram of basic MAC encoder, MAC receiver /decoder - Standards of wide dimension HDTV - Introduction to HI-Vision & European MAC System, - Block diagram of OFDM based DVB (DVB-T)transmitter - Advantages & disadvantages of OFDM –based DVB system - Block diagram of ATSC HDTV broadcast transmitter based on 8VSB modulation system - Advantages & disadvantages of 8VSB modulation 5.4 Non radiating Video system : - Block diagram of Closed circuit TV (CCTV), Applications of CCTV , - Block diagram of Master antenna TV (MATV) , - Cable TV (CATV),channels for cable ,Two way cable system, features of digital CATV	14
6 Audio / video recording & reproduction	1 State features / specifications of CD 2 State advantages of CD 3 Draw & describe the concept of recording &	6.1 CD & its specifications, Features of Compact Disc, Advantages of compact Discs 6.2 Audio & Video recording on DVD:	10

	playback of DVD with diagram 4 Describe various methods to increase capacity in DVDs 5 Draw block diagram of DVD/BD player & describe its working 6 Draw structure of DVD & BD 7 State features & Applications of DVDs 8 Illustrate the concept of Blu-Ray Disc 9 State advantages of blu-ray disc 10 Compare DVD & BD 11 State need of compression 12 Describe various methods of compression 13 Describe JPEG compressor & Decompression with block diagram 14 Describe stepwise JPEG compressor process 15 State Limitation & applications of JPEG 16 Describe MPEG-1/ MPEG-2 /MPEG-4 compression standards 17 State MPEG-1-video compression layers, 18 Describe with diagram MPEG-1 compression by comparing frames , MPEG-1-video compression layers, 19 Describe MP audio layers compression 20 Analyze different compression techniques 21 Identify the given Block diagram of /CD/DVD/BD 22 Analyze the given block diagram for missing block or by replacing one block with another block for system performance	- Digital Video disc (DVD) , - DVD formats , - Recording & playback on DVD , - Techniques used to increase capacity in DVDs - Features & Applications of DVDs - Block diagram of DVD player 6.3 Blu –Ray Disc: - Blu –Ray Disc structure - Advantages of BDs, - Comparison of DVD & BD, - Block diagram of blu-ray disc player 6.4 Compression standards for digital TV: - Need for compression - Methods of compressions - Need of compression standards - JPEG- block diagram & stepwise description of JPEG compressor system - Limitation & applications of JPEG - Introduction to JPEG 2000 - MPEG-1-video compression layers, compression by comparing frames , transmission of MPEG coded signal, weakness of MPEG-1, - MPEG-2, MPEG-4 6.5 MP audio layers	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
01	Measure audio intensity level of various sounds with the help of suitable audio level meter	Audio Fundamentals	02
02	Check the audio frequency range of various sounds by connecting signal generator /mike on input side and loudspeaker/ CRO/ DSO/ spectrum analyzer on output side		02
03	Test various functions of Hi Fi amplifier system.	Audio Amplifiers & Systems	02
04	Check the performance of graphic equalizer by plotting its frequency response.		02
05	Collect information & compare performance parameters of various audio systems & their components like special microphones/Headphones/Speaker Baffles & Enclosures/Multispeaker systems/Stereo systems/Equalizers & mixers/ PA system/ Surround sound system/Synthesizer (at least three brands) and Prepare report (make groups of 4 or 5 students)		04
06	Obtain composite video signal by using colour TV pattern generator and measure its dimensions	TV Fundamentals	02
07	Test various functions & explore various settings of colour TV /colour TV remote control unit/ digital TV	Colour TV	02
08	Trace video IF/chroma/ vertical / horizontal / sound sections/ video output/power supply sections of given colour TV		02
09	Test given colour TV receiver for various faults in video IF/chroma/ vertical / horizontal / sound / video output/power supply sections of given colour TV supply section etc		04
10	Check the connections of DTH System and explore all the functions	Video Systems	02
11	Collect information & compare performance parameters of various Video systems like colour TV /Digital TV/ LED TV/ HDTV/DTH/TFT monitor/ DLP projector/(at least three brands) and Prepare report (make groups of 4 or 5 students)		04
12	Test various functions of DVD / BD Player & check drive mechanism layout of DVD / BD Player	Audio / video recording & reproduction	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	Audio Fundamentals	02(04)	04(00)	00(00)	06(04)
02	Audio Amplifiers & Systems	02(02)	06(04)	04(00)	12(06)
03	TV Fundamentals	04 (04)	04(04)	04(00)	12(08)
04	Colour TV systems	04(00)	06(04)	04(04)	14(08)
05	Video Systems	04(02)	06(06)	04(00)	14(08)
06	Audio / video recording & reproduction	02(00)	10(00)	00(06)	12(06)
	Total	18(12)	36(18)	16(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	3	R	2	6	R	2	2	R	2	5/7
	5	R	2																
02	4	R	4	5	R	4	1	U	4	1	R	4	3	R	4				3/5
03	3	U	4	3	A	4	2	A	4	3	U	4	2	U	4				3/5
04	6	U	4	5	A	4	4	A	4	4	U	4	4	A	4				3/5
05	2	U	6	5	U	6	5	U	6										2/3
06	4	U	6	6	U	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 block diagram, selection of equipment's/trainer kit, writing procedure etc.	10
2	Performance-Connecting Equipments/Trainer kit, Identification of different sections of given audio/video system OR Tracing of given circuit OR Simple Fault finding in audio/video systems Obtaining waveforms of input, output or different testing points OR Testing ,Exploring different functions of given audio / video system	10
3	Result: Drawing Waveforms (if any),Analyzing waveforms	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	-	-	3	-	3
2	-	3	-	-	3	3	3	-	-	3	-	3
3	-	3	3	-	-	-	-	-	-	3	-	3
4	-	3	3	2	3	-	3	2	-	3	2	3
5	-	3	3	2	-	-	-	2	-	3	2	3
6	-	3	3	2	-	-	-	2	-	3	2	3

1: Low (Slight)

2: Moderate (Medium)

3: High (Substantial)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Audio And Video Systems	R.G Gupta, Tata McGraw-Hill Second Edition, Fifth reprint 2012	0070699763, 9780070699762
2.	Television Engineering And Video systems	R.G Gupta, Tata McGraw-Hill Second Edition, Third reprint 2012	0071077812, 9780071077811
3.	Consumer Electronics	S.P. Bali ,Pearson Education, Second Impression ,2009	9788131717592

4	Modern TV Praticce	R.R Gulati New age International Pvt. Ltd, Fifth Edition,2015	978-81-224-3784-3
5	Audio And Video Systems	S.P. Bali ,Rajeev Bali ,Khanna books publishing , First Edition, 1999	8187522054
6	Monochrome and Colour Television	R.R Gulati,New age InternationalPvt. Ltd, Second Edition ,2005 , Reprint 2010	9788122416077
7.	Television & Video Engineering	A.M Dhake Tata McGraw-Hill, Second Edition,1999	0074601059.

❖ **E-REFERENCES:**

- <http://electronics.howstuffworks.com/analog-digital3.htm>, assessed on 25thOctober 2016
- <http://electronics.howstuffworks.com/dtv.htm>, assessed on 25th October 2016
- <http://electronics.howstuffworks.com/tv10.htm>, assessed on 25th October 2016
- <http://electronics.howstuffworks.com/dvd.htm>, assessed on 25th October 2016
- <http://electronics.howstuffworks.com/high-fidelity-high-definition.htm>, assessed on 25thOctober 2016
- <http://nptel.ac.in/courses/106105082/38>, assessed on 25th October 2016

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

1. CRO (100MHz)
2. Digital Storage Oscilloscope
3. Digital Multi-meter
4. Color TV Pattern generator
5. Audio level meter
6. DB Meter
7. Color TV, Digital TV,HDTV,DVD player trainer kit with fault finding facility
8. PA system with microphones & speakers
9. DTH system

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics& Telecomm. Engineering	Government Polytechnic, Nagpur.
2.	Mrs. U. M. Ramteke	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
3.	Mr. D. A. Brahmanekar	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
4.	Ms. K.P. Giri	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.

5.	Mrs. R. Vairagade	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
6.	Mrs. U. P. Podar	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
7.	Mr. S.V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
8.	Mrs. Gazala Ali	Head of Electronics Engineering	Anjuman Polytechnic ,Nagpur
9.	Mr. S. M. Kale	Lecturer in Electronics Engineering	Government Polytechnic, Gadchiroli

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC412E
COURSE TITLE	: POWER ELECTRONICS
PREREQUISITE	: EC401E
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.	: 01 HR

❖ RATIONALE:

The aim of this course is to provide exposure of some power electronic converters that are utilized by the industries and describes the fact, principle and technique of electronics devices like solid state power devices, inverter, chopper and circuits and their applications in electronic systems, so that students can use knowledge in acquiring supervisory skills and prototype testing skills.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze the construction and characteristics of power electronic devices.
2. Identify the different testing skills of industrial system.
3. Select power electronic circuits for different control application.
4. Develop triggering circuits for SCR.
5. Assemble different types of power electronic circuits.
6. Test the circuits with power electronic components for different applications.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Power Electronics Devices	1. Draw the symbols of different power electronics devices. 2. Define the different terms related to power electronics devices 3. Describe the V-I characteristics of SCR, TRIAC, DIAC, UJT. 4. Describe the different regions of operation of SCR. 5. Describe the construction and working of power electronics devices. 6. State advantages, disadvantages and application of power electronic devices. 7. State the features of a GTO. 8. Compare between different power electronics devices.	1.1 Symbol, Working principle, Characteristics, Advantages, Disadvantages and applications of • Power Transistor • Power MOSFET 1.2 Construction, Symbol, Working principle and Characteristic of Silicon Controlled Rectifier(SCR) 1.3 Definition related to SCR:- • Latching current • Holding current • Forward break overvoltage • Forward leakage current • ON state voltage. 1.4 Two Transistor Analogy of SCR. 1.5 Symbol, Working principle, Characteristics of • Light activated SCR (LASCR) • Uni-junction transistor (UJT) • Gate Turn Off SCR(GTO) • IGBT (Insulated gate bipolar transistor) • DIAC • TRIAC 1.6 Advantages, Disadvantages and applications of SCR, LASCR, UJT, DIAC, TRIAC, IGBT, GTO.	10
2. Triggering And Commutation	1. State different turn on and turn off methods of SCR. 2. Describe various triggering methods of SCR. 3. Define commutation. 4. List the types of commutation. 5. Describe commutation methods of SCR. 6. Classify SCR triggering methods. 7. Describe the operation of UJT SCR triggering method. 8. Describe how SCR commutates in Class A and Class B methods. 9. Compare between natural-forced and voltage - current commutation. 10. Design the UJT relaxation oscillator and draw its	2.1 Need of triggering of SCR. 2.2 SCR Turn ON Methods- Thermal triggering, Light triggering, Forward voltage triggering, Gate current triggering, dv/dt triggering. 2.3 Circuit diagram, Working principle and Waveforms of triggering circuits using-R, RC, UJT relaxation oscillator. 2.4 SCR Turn OFF Methods (Commutation) Types – Natural, Forced. 2.5 Circuit Diagram, Working of different commutation methods Class A, Class B, Class C, Class D, Class E and Class F. 2.6 Equivalent circuit for series and parallel connection of SCR.	08

	characteristics.		
3. Phase Controlled Converters	- Describe with circuit diagram of 1-Phase fully controlled half wave rectifier with RL load and freewheeling diode. - State importance of freewheeling diode. - Describe with circuit diagram of single phase full wave half controlled bridge rectifier for RL load with and without free wheeling diode. - State the effect of source inductance in control rectifier. - State the advantages of full control rectifier. - State applications of control rectifier. - Compare between controlled HWR and controlled FWR. - Classify control rectifier on the basis of input supply. - State the principle of operation of cycloconverter. - Analyse the single phase controlled half wave rectifier with RL load.	- Principle of Phase angle control. - Classification of Controlled rectifiers. - Circuit diagram, Working principle and waveforms of single phase half wave controlled rectifier (HWR) & full wave controlled rectifier (FWR) with R, RL, RL with freewheeling diode - (no derivation) - Working principle and waveforms of three phase converter using power diode and SCR- (HWR and FWR) - Necessity, principle of cycloconverter-(concept only), types of cycloconverter, Advantages, Disadvantages and Applications of cycloconverter.	10
4. Inverters	- Classify inverter. - State necessity of an inverter. - State drawbacks of series inverter. - Describe the operation of series inverter, improved series inverter and parallel inverter. - State the advantages, disadvantages and applications of inverter. - Compare series and parallel inverter. - Design the improved series inverter and draw its waveform.	- Necessity, Classification, Principle of operation of inverter. - Circuit diagram, Working principle and waveforms of- - Series inverter, - Improved series inverter - Parallel inverters. - Advantages, Disadvantages and Applications of inverters. - Comparison between series and parallel inverter. - Differentiate between Converter and Inverter.	08
5. Choppers	- List applications of chopper. - Classify chopper. - Describe the operation of step up chopper with circuit diagram. - List the features of	- Introduction - Necessity of Chopper. - Classification of Chopper - Circuit diagram, Working principle and Waveforms of- - Basic chopper circuit - Step up	05

	chopper. 5. State the principle of basic chopper circuit. 6. State the necessity of chopper. 7. Describe the operation of step down, step up, Morgan and Jones chopper with circuit diagram and waveform. 8. Compare step up and step down chopper.	• Step down • Morgan chopper • Jones chopper 5.5 Applications of chopper.	
6. Control of DC Drives and Power Electronic Applications	1. Describe the operation of speed control of dc shunt motor using armature voltage control method and field current control using SCR. 2. Demonstrate the principle of dc time delay relay using SCR and PUT. 3. Illustrate the functioning of light dimmer circuit.	6.1 Dc motors: Speed control of DC shunt motor using armature voltage and field current control using SCR. 6.2 DC time delay relay using SCR and PUT. 6.3 Applications Of TRIAC- • Phase control using TRIAC • Light dimmer using TRIAC 6.4 Power Electronic Applications • Ac voltage stabilizer using SCR • Flasher Circuits • Emergency light system, • Battery charger, • Smoke detector using SCR. • Fan regulator.	07
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Collect the specification of different power electronics devices from the data sheet and. Prepare a report for them.	Power Electronics Devices	2
2.	Test the SCR by measuring Holding current and Latching current by setting proper value of gate current of SCR. Measure forward current for various forward voltage and plot V-I characteristics of SCR. Find the value of forward break over voltage.		2
3.	Measure output current for input forward voltage and reverse voltage applied, Plot the V-I characteristics of DIAC, Find the breakdown voltage.		2
4.	Set the proper value of gate current of TRIAC. Measure forward current for various forward voltage ,measure reverse current for various reverse voltage, and plot V-I characteristics of TRIAC.		2
5.	Set the value of Forward and reverse breakdown voltage. Find the value of On state voltage. Plot the V-I characteristics of IGBT.		4
6.	Develop triggering circuits of SCR using UJT.	Triggering Circuits	4
7	Measure the average output voltage. Connect Half-wave controlled rectifier with CRO and Plot the input and output waveforms.	Phase Controlled Converters	2
8	Measure the value of load voltage. Connect series inverter circuit with CRO and Plot the waveforms.	Inverters	2
9	Measure the voltage and current of Step up chopper and plot the V-I characteristics of step up chopper.	Choppers	2
10	Assemble the circuit of Light dimmer using TRIACand observe its functioning.	Control of DC Drives and Power Electronic Applications	4
11	Mini project: Design power electronics circuit using power electronics devices. • Test its functioning. • Prepare report.		4
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	Power Electronics Devices	04(00)	10(08)	00(00)	14(08)
02	Triggering And Commutation	00(02)	04(04)	06(00)	10(06)
03	Phase Controlled Converters	02(04)	08(04)	06(00)	16(08)
04	Inverters	02(00)	08(00)	00(06)	10(06)
05	Choppers	02(00)	08(00)	00(06)	10(06)
06	Control of DC Drives and Power Electronic Applications	00(02)	00(04)	10(00)	10(06)
	Total	10(08)	38(20)	22(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	4	R	2	5	R	2	5/7
	6	R	2																
02	1	U	4	2	U	4	3	R	4	4	U	4	5	U	4				3/5
03	1	U	4	2	U	4	3	U	4	4	U	4	5	U	4				3/5
04	1	U	4	3	U	4	3	U	4	6	U	4	6	A	4				3/5
05	1	U	6	2	A	6	3	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 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
3	-	3	3	-	-	-	-	-	-	3		3
4	-	3	3	2	-	-	2	2	-	3	3	3
5	-	3	3	2	-	-	2	2	-	3	3	3
6	-	3	3	2	-	-	2	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.	Principles of Electric Machines and Power Electronics	P.C. Sen, Wileyand Sons,India Pvt. Ltd. 2007	13 :9788126511013
2.	Power Electronics	M.D Singh, K. B. Khanchandani Tata McGraw Hill. - 2 nd Edition, 1998	13:9780070583894
3.	An Introduction to Thyristors And Their Applications	M. Ramamoorthy East-West Press Pvt. Ltd. 2 nd Edition	9780333256947
4.	Industrial and Power Electronics	G.K. Mithal, KhannaPublishers Edition:	13: 9788174091093
5.	Thyristors-Theory and Applications	Sugandhi KK, Sugandhi RK Wiley, 1981	9780470271346
6.	Industrial and Power Electronics	Harish C. Rai, Umesh Publications. 5 th Edition, 1994	10:8175150459

7.	Power Electronics : Devices, Converters, Application	Vedam Subrahmanyam Publication 2 nd Edition-1987	9788122417470
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❖ **E-REFERENCES:**

- www.worldcat.org/title/introduction-to-thyristors-and... assessed on 28th September 2016
- nptel.ac.in/courses/108101038, assessed on 28th September 2016

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

1. Digital Multi-meter 3.5 digit with R , V, I measurements, diode and BJT testing
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based
Bandwidth 20 MHz/30 Mhz
3. Function Generator 1 MHz , sine, square, triangular, ramp and pulse generator Freq range
0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
4. Regulated Power Supply 0- 30 Volt, 2 A with digital display

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

S.N.	Name	Designation	Institute / Industry
1	Prof. S. S. Tadas	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
2	Prof. A. A. Ali	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
3.	Prof. K. P. Yenurkar	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
4.	Prof. D. A. Brahmanekar	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
5	Prof. R. R. Vairagade	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
6.	Prof. K. G. Giri	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
7.	Prof. P. L. Tirpude	Lecturer in Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
8.	Mr. Sandip V Darwhekar	Director	Beta computronics pvt ltd , Nagpur
9.	Mrs. Gajala Ali	Head of Electronics Engineering	Anjuman Polytechnic , Nagpur
10.	Mr. S M Kale	Lecturer in Electronics Engineering	Government Polytechnic, Gadchiroli.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC413E
COURSE TITLE	: ELEMENTS OF MECHATRONICS
PREREQUISITE	: ME305E
TEACHING SCHEME	: TH: 02; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 03 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH. TEE	: 01 Hr. (Objective Type Online Examination)
PR. TEE	: 02 Hrs (Internal)
PT.	: 30 MINUTES (Objective Type offline Examination)

❖ RATIONALE:

Mechatronics is a synergistic combination of precision mechanical, electronic & control systems engineering in the design of products & manufacturing processes. Most products in the marketplace are made up of interdependent electronic and mechanical components and electronics/electrical engineers work in organizations that are involved in both mechanical & electronic/electrical activities. This subject offers electronics engineers' expertise needed to face these new challenges.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Select appropriate mechanical & electronic elements to design a mechatronic system.
2. Modify a given mechatronic system to obtain the desired output.
3. Analyze different mechatronic systems.
4. Model and build mechatronic systems and implement these.
5. Test different types of sensors.
6. Carry out development projects independently and in teams.

❖ **COURSE DETAILS:**
A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
01. Introduction to Mechatronics	1. Identify the basic elements of mechatronics system. 2. Enlist the applications of mechatronics.. 3. State the merits and demerits of mechatronics. 4. Identify the elements of a control system. 5. Classify different control systems based on its components. 6. Enlist the examples of mechatronic systems. 7. Name the missing elements of a control system. 8. State the output of the system from the given block diagram.	1.1 Elements of mechatronics system 1.2 Mechatronics Design Process 1.3 Traditional and Mechatronics design approach 1.4 Scope of Mechatronics 1.5 Applications of mechatronics 1.6 Elements of a Measurement System 1.7 Control Systems – Requirements, Types, Feedback principle, Open and Closed loop system, Basic elements of feedback control systems, Examples of feedback control systems 1.8 Advantages and disadvantages of mechatronics systems. 1.9 Examples of mechatronics system	08
02.Sensors and Transducers	1. Define a smart sensor. 2. Define various performance criteria for sensors. 3. State the working principle of a specific transducer. 4. Select a particular sensor for measurement of a physical quantity. 5. State Hall effect. 6. State Seebach effect. 7. State Peltier effect.	2.1 Smart Sensors 2.2 Performance Criteria 2.3 Static and Dynamic characteristics 2.3 Working Principle, Characteristics, Types in brief of– Displacement Sensors (LVDT, RVDT, Capacitive), Pressure Sensors (Bellows, Differential Gauge), Temperature Sensors (RTD, Thermistor, Thermocouple), Light sensors (Photodiode, Photodarlington) Working Principle, Construction and Characteristics of - 2.4 Proximity Sensors - Eddy current sensor, Inductive sensor, Proximity Switch 2.5 Optical Encoder 2.6 Piezoelectric and Tactile Sensor 2.7 Hall effect sensor 2.8 Inputting data by switches, Debouncing, Keypads	06
03.Signal Conditioning	1. Define Signal conditioning. 2. Enlist the basic signal conditioning processes. 3. Identify the output of the	3.1 Need of Signal conditioning 3.2 Basic Signal Conditioning processes - Isolation & Impedance Conversion, Noise reduction and	04

	circuit from the given circuit diagram. 4. Convert voltage into appropriate frequency and vice-versa. 5. Measure unknown resistance using Wheatstone bridge. 6. Select a particular op-amp based circuit depending on its application.	filtering, Amplification, Linearization and Signal Conversion 3.3 Linear Op-amp circuits (<u>only circuit diagram and output equations expected</u>)- Inverting amplifier, Non-inverting amplifier, Instrumentation amplifier, Log amplifier, Comparator 3.4 Noise Reduction – High pass filter, Low Pass filters, op-amp based Passive & Active filters 3.5 Wheatstone bridge 3.6 V to I converter and I to V converter 3.7 V to F converter and F to V converter Overview of Data Conversion Elements (<u>types, Basic ICs of-</u>) 3.8 Analog to Digital Converter (ADC) 3.9 Digital to Analog Converter (DAC) 3.10 Data Acquisition Systems (DAS) – Computer with plug – in boards, Data Loggers	
04.Actuators	1. State the function of various control valves. 2. Identify various parts of a stepper motor and illustrate its working principle. 3. Select a particular motor depending upon the system design requirements. 4. Define lag, steady state error. 5. Select proper mechanical assembly required as per system design. 6. Identify the control mode to be used for a particular output.	4.1 Actuating Systems – Hydraulic, Pneumatic systems 4.2 Pneumatic Actuators - Direction Control Valves – Spool, Poppet, pilot operated, Directional Valves, Valve actuation symbols 4.3 Pressure Control Valves – Pressure regulating, Pressure Limiting 4.4 Cylinders – Single acting, Double acting 4.5 Mechanical Actuators - Types of motion (Translational, Rotational), Kinematic Chains (Four bar chain, Slider-crank mechanism), Cams (Eccentric, Heart shaped, Pear Shaped), Cam followers, Gears (Gear trains, rack-and-pinion gears), Ratchet & Pawl, Bearings (Plain journal, Ball and roller bearings) 4.6 Electrical Actuators – Stepper motor – Types (Variable reluctance, Permanent magnet, Hybrid Stepper motor), Stepper motor specifications, Stepper motor Control 4.7 Closed loop controllers – Terminology (Lag, Steady state	06

		error, Control modes), Control modes - Two Step, Proportional (P), Derivative (D) Proportional-Derivative (PD), Integral, Proportional-Integral (PI), Proportional-Integral-Derivative (PID)	
05.Robotics	1. State the laws of robotics. 2. Classify robots based on different criteria. 3. Define Manipulator robot, Tele-operator, Prosthesis, Exoskeleton, Biological, Fixed, Mobile, α-class, β-class, γ-class, Manipulator, Sequence, Playback, Numerical Control (NC), Intelligent robots. 4. State the degrees of freedom for a robot. 5. Elaborate the anatomy of a robot. 6. Identify various parts of a robot. 7. Define and state the significance of Resolution, Accuracy & Repeatability in robot design. 8. Identify and use specific robot configuration based on system design need. 9. Select appropriate end effector for a specified application. 10. State the selection parameters for a robot. 11. Enlist the safety measures to be taken while handling robots. 12. Enlist the applications of robotics. 13. State the Selection parameters for application areas where a robot can be used 14. Design a robot for a specified application.	6.1 Introduction – Laws of robotics 6.2 Classification of robots – General Classification (Manipulator, Tele-operator, Prosthesis, Exoskeleton, Biological), Based on robot generation (First, Second, Third, Fourth, Fifth), Based on Structure capability (Fixed, Mobile), Based on Intelligence (α-class, β-class, γ-class), Based on use (Automatic manufacturing, Remote exploration, Biomedical applications, Hazardous material handling, Service robot) 6.3 Industrial robots – Manipulator, Sequence, Playback, Numerical Control (NC), Intelligent robots 6.4 Degree of freedom & Degree of motion 6.5 Parts of a Robot 6.6 Work Volume & work envelope 6.7 Resolution, Accuracy & Repeatability 6.8 Robot Configurations – Cartesian, Cylindrical, Polar, Articulated, Selective Compliance Assembly Robot Arm (SCARA) & Spine 6.9 Robot End effectors – Grippers, Tools used as end effectors 6.10 Selection parameters of a robot 6.11 Selection parameters for application areas where a robot can be used 6.12 Applications- Engineering and General 6.13 Safety measures while using robots	08
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify various elements the given mechatronic system.	Introduction to Mechatronics	2
2	Select a particular sensor for a given mechatronic system making use of data sheets and market survey.	Sensors and Transducers	2
3	Test the sensor in the given mechatronic system for proper functioning.		2
4	Find the equivalent frequency generated from applied voltage by using a V to F converter.	Signal Conditioning	2
5	Design a computerized data logging system with control for process variables like pressure, flow or temperature.		2
6	Design a system for rotating a stepper motor in clockwise or anticlockwise direction by using microprocessor / microcontroller/ PLC module.	Actuators	2
7	Design a robotics system for a pick and place application.	Robotics	4
8	Identify the mechatronic systems in a car and illustrate any one.	Assignment	2
9	Industrial visit to a manufacturing unit where mechatronics is used for production purpose and prepare report.		4
10	Prepare a report on mechatronics used in a camera system. (Case Study)		2
11	Develop a mini project based on mechatronics or robotics.	Mini - Project	6
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	Introduction to Mechatronics	04	08	04	16
02	Sensors & Transducers	08	04	02	14
03	Signal Conditioning	00	04	04	08
04	Actuators	04	08	02	14
05	Robotics	06	08	04	18
Total		22	32	16	70

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 to 35	1	R	2	1	R	2	1	U	2	1	U	2	1	U	2	1	U	2	35/35
	1	A	2	1	A	2	2	R	2	2	R	2	2	R	2	2	R	2	
	2	U	2	2	U	2	2	A	2	3	U	2	3	U	2	3	A	2	
	3	A	2	4	R	2	4	R	2	4	U	2	4	U	2	4	U	2	
	4	U	2	4	A	2	5	R	2	5	R	2	5	R	2	5	U	2	
	5	U	2	5	U	2	5	U	2	5	A	2	5	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
		Assignments		Continuous	10	--	Assignment Book / Sheet	1, 2, 3
	TEE (Term End Examination)	End Exam	Students	End Of the Course	70	28	Online Exam Report	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 equipments, writing procedure etc.	10
2	Performance	10
3	Calculation, Result, Drawing Graphs(if any)	05
4	Viva voce	10
5	Mini projects	15
	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	-	-	1	1	-	3	3	3
2	3	3	-	3	-	-	-	-	-	-	3	3
3	3	-	-	-	-	-	-	-	-	3		3
4		3	3	3	-	-	1	1	-	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.	Mechatronics	W. Bolton, Pearson Education, India, Fourth Edition, 2008	8131762572 9788131762578
2.	Mechatronics (Integrated Mechanical Electronics System)	K.P. Ramchandran, G. K. Vijayraghavan, M.S. Balsundaram, Wiley India Pvt. Ltd., First Indian Edition, 2008	8126518375 9788126518371
3.	Mechatronics : An Introduction	Robert Bishop, CRC press, 2008	0849363586
4.	Mechatronics	J. Paulo Davim, Wiley India Pvt. Ltd. 2011	1848213085 9781848213081
5	Robotics	Appu Kuttan K. K., I. K. International Pvt. Ltd., First Edition, 2010	8189866389 9788189866389

❖ **E-REFERENCES:**

1. nptel.ac.in/courses/112103174 , assessed on 30th August, 2016
2. nptel.ac.in>courses>pdf>mod7 , assessed on 30th August, 2016
3. video_demos.colostate.edu>mechatronics , assessed on 30th August, 2016

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION****1. Data logger****Specifications:**

1. Casing Polycarbonate, watertight to IP68 Humidity loggers splash proof from top
2. Size 65 × 31 × 106 mm
3. Weight 115 g
4. Ambient -40 + 85 °C
5. Battery 1 × ½AA, 3.6V
6. T-TEC 6: Expected battery life: 3-4 years
7. T-TEC 7: Expected battery life: 2 years, Low battery warning on display
8. Sensor (see sensor specifications) Temperature: Precision Thermistor or Pt100
9. Humidity: capacitive precision
10. Memory E model: 12,000 to 25,000 sets of measurements
11. C model: 10,600 sets each sensor
12. F model: 10,600 sets each sensor (21,200 if only one)
13. A & P: 20,000 to 60,000 sets of measurements
14. Interface Special interface cable to serial port and/or special interface cable to USB Port
15. Security ID Permanent serial number
16. Warranty 1 Year (not incl. sensor)
17. Resolution Temperature: Better than 0.1 °C (see sensor specifications)
18. Humidity: Better than 0.1%RH

2. Robot Controller Module**Specifications:**

1. Processor: ATmega32U4 @ 16 MHz
2. RAM size: 2560 bytes
3. Program memory size: 32 Kbytes
4. Motor driver: DRV8838
5. Motor channels: 2
6. User I/O lines: 26
7. Input voltage range: 2.7 V to 11 V
8. Minimum operating voltage: 2.7 V
9. Maximum operating voltage: 11 V
10. Maximum output current: 1.5 A
11. Continuous output current per channel: 1.8 A
12. Peak output current per channel: 1.8 A
13. Logic voltage: 5 V
14. Reverse voltage protection?: Y
15. External programmer required?: N

3. **Mechatronics Kit**

Specifications:

Hardware:

1. 24VDC motor with attached 1000 counts/rev optical encoder
2. Two additional 1000 counts/rev optical encoders
3. Aluminum links and mounts to construct the experiments
4. TI TMS320C6713 DSK Board (DSP board with USB interface)
5. PWM/Optical Encoder Data Acquisition Daughter Board. (Mates with DSK Board)
6. PWM Motor AMP Board
7. Terminal Board to integrate with Quanser experiments
8. 5VDC and 24 VDC power supplies and all needed cables

Software Included:

1. TI's Code Composer Studio supplied with the DSK Board - A complete Integrated Development Environment(IDE), an efficient optimizing C/C++ compiler assembler, linker, debugger, an advanced editor with Code Maestro™ technology - DSP/BIOS™ real time kernel
2. Example source files of different controllers for the plants.
3. Visual Basic Interface software examples. All source code included
4. Simulink blocks for communication with the DSP for use with WinCon or RTWT (both sold separately)

DSP Board:

TI TMS320C6713 DSK Board is Texas Instruments' new development system kit for the 225MHz TMS320C6713 floating point DSP. Included on the C6713 board are the following components:

1. Highest-Performance Floating-Point Digital Signal Processor (DSP) C6713
2. 225 MHz, up to 1800 MIPS and 1350 MFLOPS
3. 512K FLASH and 16MB SDRAM
4. Native Instructions for IEEE 754, Single- and Double-Precision Floating point support
5. Two Buffered Serial Ports
6. Two Inter-Integrated Circuit Bus (I2C Bus™) Multi-Master and Slave Interfaces
7. Two 32bit general-purpose timers
8. Expansion port connector for plug in modules

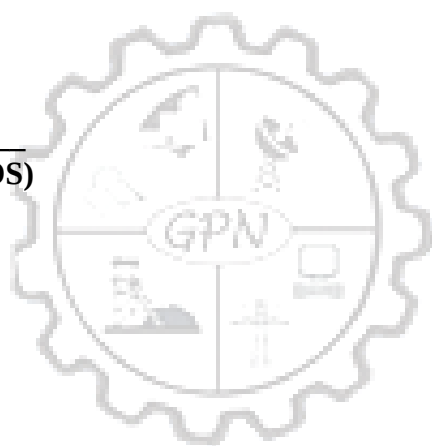
Data Acquisition board

1. 2 Channels (can be upgrade to 4) of 24 bit quadrature optical encoder input
2. 2 Channels of PWM output. (can be upgraded to 4)
3. Parallel port interface to convert DSP system into a "dumb" data acquisition system. Could also be used as 8 lines of general purpose digital input and 8 lines of digital output.

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

S.N.	Name	Designation	Institute / Industry
1.	Shri S. S. Tadas	HOD, Electronics (I Shift)	Government Polytechnic, Nagpur.
2.	Shri A. A. Ali	HOD, Electronics (II Shift)	Government Polytechnic, Nagpur.
2.	Shri D. A. Brahmanekar	Lecturer, Electronics	Government Polytechnic, Nagpur.
3.	Ms. K. G. Giri	Lecturer, Electronics	Government Polytechnic, Nagpur.
4	Mr. Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs. Gazzala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur.
6	Mr. S. M. Kale	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Gadchiroli.

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GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM.ENG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC414E

COURSE TITLE : MAINTENANCE OF ELECTRONIC EQUIPMENTS

PREREQUISITE : EC407E

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:**

This course is designed for the students who have the knowledge of most of the electronic equipment and instruments. Being an electronics engineer, it is essential for a student to have the knowledge of testing and maintenance of electronic equipment and instruments. This course introduces various electronic test equipments, testing procedures, troubleshooting procedures and troubleshooting of linear & digital circuits

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Identify and test different hand tools required for maintenance.
2. Use CRO, signal generator, pulse generator, function generator, multimeter for measurements.
3. Trace and interpret the circuit diagram.
4. Test different active and passive components.
5. Locate and Repair the faults in electronic equipment.
6. Maintain electronic equipment.

❖ **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	Identify different hand tools required for maintenance, demonstrate, draw diagram, state its function and use, (Screw driver, pliers, tweezers, wire stripper, scribes, hacksaw, files, bench vice, drilling machine, drilling bits (0.8, 1.0, 1.2, 1.5mm))	Concept of Maintenance	02
2	Prepare flowchart for Maintenance steps (Preventive, predictive and breakdown maintenance) and write safety measures while handling equipment		02
3	Measure A.C. voltage and D.C. voltage using millimeter for the given circuit.		02
4	Perform continuity test of PCB track and wiring using multimeter		02
5	Inspect solder joints, and repair defects of soldered joints in given circuits.		02
6	Test resistor, capacitor and inductor by using multimeter, LCR meter, CRO.	Testing of Electronic Components	02
7	Test Transistor by using multimeter and transistor TESTER, CRO.		02
8	Test IC using IC tester.		02
9	Test variable resistors, connector, switches, by using multimeter.		02
10	Test diodes, zener diode, varactor diode, VDR, Photo diode, Tunnel diode, LDR using multimeter.		02
11	Test Thermistor, 7 segment display, FET, MOSFET, SCR, Triac with help of multimeter		02
12	Identify faults in given power supply 1. Identify different sections 2. Trace voltage regulation section in given power supply 3. Measure Voltage at test points in given power supply 4. Use service manual.	Maintenance of Power supply	08

13	Identify faults in given function generator 1. Identify different sections 2. Trace alternation section used in function generator 3. Measure Voltage at test points in given power supply 4. Use service manual.	Maintenance of function generator	08
14	Identify faults for given CRO 1. Identify different sections 2. Trace vertical section in CRO 3. Measure Voltage at test points in given CRO 4. Trace Signal in CRO at different sections 5. Use service manual	Maintenance of CRO	08
15	Visit web site to get information about manufactures, Specification and cost which will be filled in tabular form for following measurement and Testing equipment's 1. logic analyzer 2. function generator 3. IC Tester 4. Accessories for SMD soldering 5. Digital storage oscilloscope	Market / Web Survey	06
16	Find equivalent components by using data book/ Internet. (at least five components in each type) 1. Transistors 2. Diodes 3. FET/MOSFET 4. IC TTL 5. IC CMOS 6 Linear IC		04
17	Prepare fault finding flow chart (at least for two faults in each equipments) (to be performed in group of 4 students) 1. Power supply 2. Function generator 3. CRO	Concept of Troubleshooting	04
18	Industrial Visit and prepare Industrial report. 1. Any service department in electronic factory 2. Any service enterprises in your city related with electronic goods.		02
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 & 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	Tracing circuit diagram, selection of equipment's. etc.	15
2	Testing of components, finding location of fault	15
3	Writing procedure, Calculation, 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	3
2	-	3	3	3	-	-	-	3	-	3	3	3
3	-	3	3		-	-	1	3	-	3	-	3
4	-	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

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 Testing & Fault Diagnosis	Loveday, George Harlow: Longman scientific and technical c1995 3 rd edition	0582252423 (pbk)
2.	Troubleshooting Electronic Equipment: Includes Repair and Maintenance,	R.S. Khandpur, Tata McGraw Hill Education, 2003 Second Edition	0071331409, 9780071331401
3.	Electronic Instruments And Systems: Principles, Maintenance And Troubleshooting	R.G. Gupta, Tata McGraw Hill Publishing Company Limited, 2001	0074636294, 9780074636299

❖ **E-REFERENCES:**

- http://www.learnabout-electronics.org/transistor_faults_04.php assessed on 14/10/2016
- <http://www.9h1mrl.org/workshop/CRO-Ebook-1/html/CRO-P9-LookingAtFaults-1.html> assessed on 14/10/2016
- <http://www.matrixtsl.com/resources/files/datasheets/LK9333%20-%20Fault%20Finding.pdf> assessed on 14/10/2016

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

1. Digital Multi-meter 3.5 digit with R , V, I measurements, diode and BJT testing
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 Mhz
3. Function Generator 1 MHz , sine, square, triangular, ramp and pulse generator Freq range 0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
4. Regulated Power Supply 0- 30 Volt, 2 A with digital display

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics & telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mrs. M.N. Bawane	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
3	Mr. D. A. Brahmanekar	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
4.	Mrs. H. R. Bhusari	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur
5.	Ms. U. M. Ramteke	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur
6.	Ms. K. G. Giri	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur
7.	Mr. Sandip V Darwhekar	Director	Beta Computronics Pvt Ltd , Nagpur
8.	Mrs. Gazzala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
9.	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 ELECTRONICS & TELECOMM.ENG.

LEVEL NAME : PROFESSIONAL COURSES

COURSE CODE : EC415E

COURSE TITLE : PCB TECHNOLOGY

PREREQUISITE : EC301E

TEACHING SCHEME: TH: 00; TU: 00; PR: 04(CLOCKHRS.)

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:**

This subject forms the foundation for technician skill development in electronics engineering. The course deals with basics of realization of user appliances and gadgets using computer aided tools for circuit making, PCB design. Various types of copper clad and etchants are studied. Different steps in PCB making and equipments involved in industrial practice are also studied.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Select appropriate components for given circuit application.
2. Use electronic workshop tools for preparing PCB
3. Trace the circuit diagram for Electronic circuits.
4. Create schematic and layout of given electronic circuit using PCB design software.
5. Fabricate PCB for the selected circuit
6. Test PCB for short and open circuits.

❖ **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.	Identify and use basic tools for electronics circuit development like Bread board, Copper clad laminate sheet, general purpose PCB ,drilling Machine , hacksaw, filesetc.	Introduction to tools and component packages	4
2	Select a circuit and its appropriate components for fabrication of PCB.Theory includes packages of different components, their sizes, use of datasheet , on board and off board components etc.		6
3	Use different features of PCB design software to draw schematic of circuit.Demonstration includes Locating the Components and Loading the Libraries, Placing the Components on the Schematic, Wiring up the Circuit, Nets and Net Labels etc.	PCB Artwork Development Using Software Tools	14
4	Prepare layout of a selected circuit on paper using different rules used for artwork design.Rules regarding thickness of track, corners, routes of track to be covered	PCB Design For Small Project	10
5	Create layout of the circuit using PCB design software.Theory includes setting up the PCB workspace , component positioning and placement options, setting up the design rules ,positioning the components on the PCB, changing a footprint, routing the board manually and automatically etc.		8
6	Trace electronic circuit from the given PCB layout of an electronic circuit.		4
7	Operate PCB manufacturing machines like Shearing machine, exposure unit, baking machine, etching machine, drilling machine	PCB Manufacturing Techniques	4
8	Prepare negative film for PCB and Transfer the artwork on copper clad		4
9	Perform etching process using FeCl ₃ and check the continuity and short circuits of the tracks using multimeter		4
11	Prepare holes required for the design using drilling machine		4
Skill Assessment			2
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	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 PCB layout on paper for given circuit diagram.	10
2	Drawing PCB layout using PCB design software for given circuit diagram.	20
3	Tracing of the circuit	10
5	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	3
2	-	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	-	-
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.	Printed Circuit Boards: Design, Fabrication, Assembly and Testing	R. S. Khandpur ,Tata McGraw-Hill Education, 2005	9780070588141
2.	Printed Circuit Boards: Design and Technology	Walter C. Bosshart, Tata McGraw-Hill Publishing Company Limited, Reprint 2009	10: 0074515497; 13: 978-0074515495
3.	Build Your Own Printed Circuit Board	Al Williams, McGraw-Hill, 2004.	13: 978-0071427838
4.	Printed Circuits Handbook, Seventh Edition	Clyde Coombs , Happy Holden, 7th Edition, 2016	978-0071467346
5.	Electronics Design and Drawing	Mrs.Nirupama Gupta, Mr.Boben, BPB Publication, First Edition, 2008	13 : 978-81-8333-110-4

❖ **E-REFERENCES:**

1. <https://www.youtube.com/watch?v=eJX6QkER1Ug>, assessed on 2nd September 2016
2. <https://www.google.co.in/#q=pcb+design+steps+ppt>, assessed on 2nd September 2016
3. <https://www.google.co.in/#q=pcb+design+software+tutorial+ppt>, assessed on 8th October 2016
4. <https://techdocs.altium.com/display/ADOH/Tutorial+-+Getting+Started+with+PCB+Design> assessed on 8th October 2016

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

1. PCB Art Work Film Maker : Manual / Automatic, Timer Adjustable from 1 Sec to 10 Sec with 1 sec interval, Display for timer and lamp status display, Buzzer for timer indication
2. PCB Shearing Machine : Mounting Base : Table Mounted / Floor Mounted
3. Photo Resist Dip Coating Machine: Timer: Adjustable from 1 Sec to 30 Sec in interval of 5 sec. Display: 16 × 2 LCD for timer. Buzzer : For timer indication
4. UV Exposure Unit : Operating Mode : Manual / Automatic, Timer : Adjustable from 1 Sec to 20 min., Display for timer and lamp status display, Buzzer: For timer indication
5. PCB Etching Machine : Spray Etching machine, Spray Motor : 0.6 HP chemical pump, Timer: Adjustable from 1 min to 30 min in interval of 5 min., Spray Mode : Automatic / Manual
6. Drill Machine: 1500 rpm which are adjustable in steps.

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S.S. Tadas	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mr. A.A. Ali	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mrs. M. N. Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mrs. H. R. Bhusari	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5.	Mr. Sandip V Darwhekar	Director	Beta computronics Pvt Ltd , Nagpur
6.	Mrs. Gajala Ali	Head of Electronics Engg	Anjuman Polytechnic , Nagpur
7.	Mr. S. M. Kale	Lecturer, Electronics Engg.	Government Polytechnic, Gadchiroli.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS AND TELECOMM.ENG.

LEVEL NAME : PROFESSIONAL COURSES (PROJECT COURSES)

COURSE CODE : EC416E^{\$}

COURSE TITLE : ELECTRONIC WORKSHOP

PREREQUISITE : EC415E

TEACHING SCHEME : TH: 00; TU: 00; PR: 04(CLOCK HRs.)

TOTAL CREDITS : 02(1 TH/TU CREDIT = 0 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE : NIL

PR. TEE : 02 HRs (External)

PT. : NIL

❖ **RATIONALE:**

This subject enhances the technician skill development in electronics engineering. It deals with application of different test and measuring instruments and electronic workshop tools used in the production of electronic gadgets. It explores various aspects and levels of electronic gadget fabrication packaging and presentation skills. The course deals with hands on practice and industrial methods of electronic equipment production and its budgeting and economics.

❖ **COURSE OUTCOMES:**

After completing this course students will –

1. Use datasheet of components.
2. Test different components.
3. Operate electronics workshop tools.
4. Prepare plan for the job work to be done.
5. Prepare mini project of electronic Gadget.
6. Test and troubleshoot electronic Gadget.

❖ **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.	Practice soldering on zero Printed Circuit Board (PCB).	Introduction to workshop and various tools.	04
2.	De-assemble existing electronic gadget using de-soldering iron. Identify the faulty components and reassemble the circuit.		04
3.	Operate following test and measuring equipments referring user's manual. - Multimeter, - LCR Q meter - Analog and digital IC tester, - Cathode Ray Oscilloscope (CRO), - Function generator.		04
4.	Use tools like - Nose pliers - cutter - stripper - soldering gun - de-soldering pump - De-soldering braid.		02
5.	Use - Temperature controlled soldering station - Hot air gun - And high speed drill machine.		02
6.	Mini Project - Select the project based on course - - Prepare flow chart (action plan) for mini project and procure different components for selected mini project.	Mini project selection, component identification and Testing	06
7.	Prepare PCB - Test visually with magnifier lens. - Perform Continuity and short circuit test of tracks. - Test Component with LCR Q meter, IC Tester, Multimeter. - Verify specifications, rating, package type, equivalency of component by referring data sheet. - Use various connectors, berg- strip (male, female) whenever necessary.		10

8.	Mount and solder the Components on PCB Perform Continuity and short circuit test.	Assembling of components	06
9.	Test and troubleshoot the circuit for specific function. • Check different parameters like • input ,output signals • voltages • current • Frequency at various test points.	Circuit Testing and trouble shooting	06
10.	Prepare cabinet for PCB and various subsystems like • Power supply, • Inputs • Outputs. • Connect different subsystems • Label various terminals. • Test entire system of project.	Project packaging	06
11.	Prepare user manual and technical manual for the gadget designed.		06
12.	Collect information for Surface mount device (SMD) components like • Resistor, • Capacitor • ICs • Tools • SMDPCBs • Prepare a report.		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	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 the circuit diagram.	10
2	Prepare connection of circuit on breadboard.	20
3	Testing of the circuit.	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	2	3		-	-	-	-	3	-	3	3	3
2	2	3	3	3	-	-	-	3	-	3	3	3
3	-	3	3	3	-	-	-	3	-	3	3	3
4	2	-	-	-	-	-	-	3		3	-	-
5	-	3	3	3	2	2	2	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.	Printed Circuit Boards: Design, Fabrication, Assembly and Testing	R. S. Khandpur ,Tata McGraw-Hill Education, 1 st edition,2005	13:9780071464208 10:0071464204
2.	PCB Design &Technology	W. C. Bosshart, Tata Mcgraw Hill , 2 nd edition ,1983	10:0074515497
3.	Printed Circuits Handbook	Clyde Coombs , Happy Holden, 7th Edition	978-0071467346
4.	Journals of Electronics field like Elektor, Electronics for you , etc	-----	-----
5.	Software user manual	-----	----

❖ **E-REFERENCES:**

- https://en.wikipedia.org/wiki/Electronics_For_You , assessed on 28th September 2016
- www.efymag.com/magazine.asp?id=12 , assessed on 28th September 2016
- <https://pocketmags.com/viewmagazine.aspx?...Electr>, assessed on 28th September 2016
- www.zapmeta.co.in/Mini+Project+Of+Electronic, assessed on 28th September 2016

C. LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION

1. CRO, Dual Channel, bandwidth 20 MHz/30 MHz
2. Function generator, 1 MHz , sine, square, triangular, ramp and pulse generator Freq range 0.01 Hz to 1 MHz, Output amplitude 20V open circuited, Output impedance 50 ohms.
3. Soldering iron, 30 watt.
4. Drilling machine, 10mm
5. Temperature controlled soldering station, 110v

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
2.	Mr. A .A. Ali	Head of Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
3.	Mrs. M. N. Bawane	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
4.	Ms. P. L. Tirpude	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
5.	Mr. S. D. Ambade	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
6.	Mr. Sandip V Darwhekar	Director	Beta Computronics Pvt Ltd , Nagpur
7.	Mrs. Gazzala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
8.	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 ELECTRONICS AND TELECOMM. ENGG.
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: EC417E ^{\$}
COURSE TITLE	: INDUSTRIAL PROJECT
PREREQUISITE	: 100 CR
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 Carryout market survey /Literature survey
- 2 Select project and Prepare planning
- 3 Perform project work in group
- 4 Test project work
- 5 Prepare project report
- 6 Present 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 - New electronic equipment/ Instrument/ gazette etc. - Microcontroller /Digital circuit based /analog based applications. - Communication based application using transmitter /Receiver. - PLC based applications. - PC based applications. - Modification and expansions of old project ,existing Instrument etc. - Industry based project. - Recent development. - Simulation Based project. 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	08
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(Day wise action plan up to completion of project) - Submit the action plan to guide. - Approve action plan from guide	Planning	08

3	I. Perform Preliminary Project work- • Prepare component list with specification of selected project. • Procurement of components. • Test the component with testing instruments • Build circuit of project on bread board and test	Project Work	20
	II. Fabricate Project work-. • Prepare the PCB art work for selected project using software. • Prepare the PCB ,test the PCB. • Prepare component layout on PCB and Solder all components.		
4	Test Project work- • List the major equipments for testing of project • Carry out stage wise test ,find fault and rectify, • Test final functional output. • Prepare, design and fabricate front panel and cabinet required for project. • Perform the final test for finished product of project. • Calculate the cost of project.	Testing	12
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 • Abstract. • Table of contents • List of Tables • List of Figures • List of abbreviations and acronyms (if any) • Text 1. Introduction, objectives 2. Literature Survey 3. Methodology/Materials/Methods/Estimate. 4. Results 5. Summary/Conclusion./Future Scope 6. 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	06
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	40	--	Rubrics & Assessment Sheets	1, 2, 3, 4,5,6
		Journal 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	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	Project Report	20
2	Group Presentation	40
6	Viva Voice	40
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	3	3	3	3	-	-
2	-	3	-	-	3	3	3	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
5	2	3	3	3		3	3	3	3	3	3	3
6	2	3	3	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.	PCB Technology	R. S. Khandpur, Tata McHill, 2005	0070588147
2.	PCB Design & Technology	W. C. Bosshart Tata McHill, 1984	0074515497
3.	PCB Design Software user manual	Myer Kutz, McGraw- Hill	0-07-141041-4
4	Data manuals from different manufacturers	Data Manual	0521202728
5	Hand books on PCB design	Coombs' Printed Circuits Handbook (McGraw-Hill Handbooks)	0071350160
6	Journals On Electronics field	Like Elektor, Electronics for you , Electronic product finder etc.	

❖ **E-REFERENCES:**

- www.electronics-project-design.com/, assessed 18th September 2016.
- <http://electronicsforu.com/> , assessed on 18th September 2016.
- <http://www.electronicshub.org/electronics-projects-ideas/> , assessed on 20th September 2016
- <http://nevonprojects.com/project-ideas/electronics-ideas/> , assessed on 20h September 2016
- <http://www.omnircircuitboards.com/blog/bid/254057/Printed-Circuit-Board-Design-Techniques-and-Best-Practices>, assessed on 20th September 2016

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

1. Cathode Ray Oscilloscope- 0 to 50 MHz
2. Digital Storage Oscilloscope-o to 50 MHz.
3. Function Generator.-0 to 50 MHz
4. LCR Q meter..
5. Digital Multi-meter

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

S.N.	Name	Designation	Institute / Industry
1.	Prof. D. A. Brahmanekar	Lecturer	Govt. Polytechnic, Nagpur
2.	Prof .Mrs. U. M. Ramteke	Lecturer	Govt. Polytechnic, Nagpur
3.	Prof. Mrs. R. R. Vairagade	Lecturer	Govt. Polytechnic, Nagpur
4.	Mr. Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
5.	Mrs. Gazzala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur.
6.	Mr. S. M. Kale	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Gadchiroli.
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 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

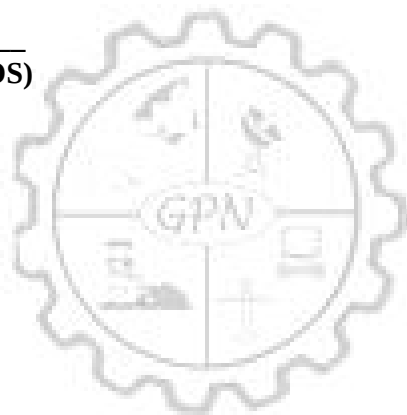
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 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

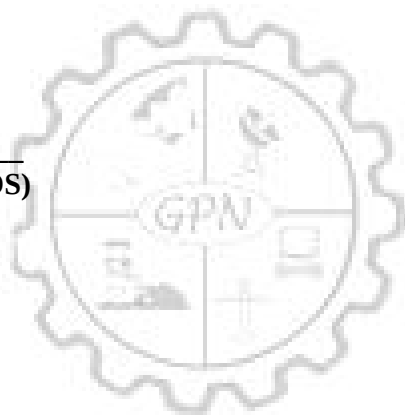
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 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 ELECTRONICS AND TELECOMM. ENGG.

LEVEL NAME : ELECTIVE COURSES

COURSE CODE : EC501E^{\$}

COURSE TITLE : EMBEDDED SYSTEM

PREREQUISITE : EC405E

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 (External)

PT. : 01 HR

❖ **RATIONALE:**

Now days Embedded Systems is need of everyone- children need embedded systems to play video games, young people need embedded systems to use cellular phones, housewives need embedded systems for home appliances, such as microwave, washing machine and so on. To make any product luxuries requires fully automation and for that we need embedded system, where we don't need user interference. By learning this course students can develop their own embedded system which is application specific to solve given real time problem by using open source platform. Thus this course is an important course for students who want to work in the automation sector of electronic industry.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Justify a simple embedded system on a microcontroller platform.
2. Access embedded systems hardware units like processor, I/O devices, On-chip and Off-chip device, power supply etc.
3. Recommend appropriate family of microcontroller for different application.
4. Develop program for small application.
5. Design relevant hardware for small application.
6. Maintain microcontroller based system.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs .
1. Overview of Embedded System	1. Define embedded systems 2. Cite examples of embedded systems 3. Identify requirement and needs of embedded systems 4. Describe architecture of embedded system 5. List selection criteria for memory and processor 6. State SOC and VLSI 7. Differentiate between Assembly language and Embedded C	1.1 Embedded System: Introduction, block diagram. 1.2 Categories of embedded systems, Requirements of embedded systems, and Applications of embedded Systems. 1.3 Hardware architectures for embedded systems. Processors 16 and 32 Bit, Memory, I/O's. 1.4 Processor and memory selection criteria. 1.5 System on chip (SoC) and VLSI introduction. 1.6 Assembly Language V/S Embedded C	10
2. Advance Microcontrollers	1. Compare RISC and CISC Processors 2. List the features of PIC, AVR, ARM Processors 3. Identify pins of ATmega8. 4. Compare different micro controllers used for embedded system designing 5. Describe AVR microcontroller with its functional diagram and block diagram of Atmega8 6. Describe Operation of to Digital Converter 7. Describe Basic peripheral Analog circuits connection required for the operation of 8 bit microcontroller (ATmega8) 8. Compare At mega 8 and At mega 328	2.1 RISC and CISC Processors 2.2 Microcontroller Types: PIC, AVR, ARM: features and applications 2.3 AVR microcontroller: Types, Architecture. 2.4 Comparison between PIC, AVR, ARM Processors 2.5 Internal Architectural, Block diagram of controller (Atmega8) 2.6 Functions of each pins of ATmega8 2.7 Configuration of Two 8-bit and One 16-bit Timers and Counters 2.8 6-channel ADC Working 2.9 Essential Peripheral circuits: Crystal Circuit, Power supply, Oscillator Circuit 2.10 Initial programming configurations of Atmega8 in C: 2.10.1 Branch, Call, and Time Delay Loop 2.10.2 Arithmetic, Logic 2.10.3 I/O port, counter, timer, interrupt 2.11 Boot loader Circuit 2.12 ISP of At mega 8 2.13 Atmega8 and ATmega328	14

3. Embedded Development Board (Arduino)	1. Describe working of open source embedded development board using block diagram 2. Identify pins of embedded development board 3. Describe circuit diagram of open source embedded Hardware. 4. Describe the features of open source tool used for programming a development board 5. Describe programming of embedded development board 6. Develop 'C' program for Serial Port with embedded development board using Atmega 8 7. Make a Basic Circuit of embedded development Board 8. Develop Program logic with 'C' using Atmega 8 9. Develop Program logic for I/O operation with 'C' using Atmega 8	3.1 Functional Block Diagram of Arduino 3.2 Functions of each Pin of Arduino 3.3 Arduino Development Board diagram (including different blocks only): 3.3.1 IDE(Integrated Development Environment) 3.3.2 I/O Functions 3.3.3 Looping Techniques 3.3.4 Decision Making Techniques 3.4 Designing of 1st sketch 3.5 Programming of an Arduino (Arduino ISP) 3.6 Arduino Boot loader 3.7 Serial Protocol (serial port Interfacing) 3.8 Initialization of Serial Port using Functions 3.9 Basic Interfacing and I/O Concept 3.10 Basic Circuit For Arduino	12
4. Communication Protocols	1. State need of communication interface in embedded system 2. Differentiate between Serial V/S Parallel Communication, Synchronous V/S Asynchronous Communication 3. Describe different serial and parallel communication protocol and parallel communication buses	4.1 Need of communication interface in embedded system. 4.2 Serial V/S Parallel Communication, Synchronous V/S Asynchronous Communication 4.3 RS232: DB9-pin functions, MAX 232, MAX 233 4.4 Serial Communication Protocols: RS-232, I2C, SPI, CAN, MODBUS, IrDA, Bluetooth 4.5 Parallel Communication Protocols: Ethernet, USB , IEEE 1394 4.6 Buses for Parallel Communication: ISA,PCI,PCI-X	08

5. Interfacing and programming Application Atmega8 using 'C'	1. List different display devices, keys, relays, keypads, ADC's, DAC's, Motors 2. Identify interfacing Pins for interfacing devices 3. Describe interfacing diagram between all peripherals and Atmega8 4. Develop logic of program to work with different interfacing devices 5. Interface different devices to Atmega8.	5.1 Interfacing Keys, LEDs and relay and its programming with 'C'. 5.2 Interfacing matrix keyboard and its programming with 'C'. 5.3 Interfacing LCD and its programming with 'C'. 5.4 Interfacing ADC and its programming with 'C'. 5.5 Interfacing DAC and its programming with 'C' for generation of different patterns. 5.6 Interfacing Stepper Motor and its programming with 'C'. 5.7 Interfacing DC Motor and its programming with 'C'	12
6. Real Time Operating System	4. State concept of RTOS 5. List requirement, need, and Specification of RTOS in embedded systems. 6. Describe terms related to RTOS such as multitasking, inter-task communication, starvation, deadlock 7. Identify problems of sharing data by multitasking	6.1 Concepts of RTOS 6.2 Requirement, Need, Specification of RTOS in embedded systems 6.3 Architecture of Real Time Operating System (RTOS). 6.4 Scheduling architecture. 6.5 Multitasking. 6.6 Share data problem. 6.7 Semaphore. 6.8 Dead lock. 6.9 Inter-task Communication.	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Identify each block of ATmega8 with Pins.	Advance Microcontrollers	2
2	Identify the features and specifications of Arduino development board.	Embedded Development Board (Arduino)	2
3	Install Arduino IDE tool.		2
4	Develop and execute C language program to blink a LED connected on port pin of Atmega8		2
5	Develop and execute C language program to generate square wave on port pin of Atmega8.		2
6	Develop and execute C language program to read the status of key from port pin and turn ON/OFF a LED connected to another port of Atmega8.		2
7	Interface 7 segment display to Atmega8. Develop and execute C language program to Display digits 0 to F on it.	Interfacing and programming Application Atmega8 using 'C'	2
8	Interface 16 x 2 LCD to Atmega8. Develop and execute C language program to display string "G P Nagpur" on it.		2
9	Interface a 4 x 4 matrix keyboard and 16 x 2 LCD to Atmega8. Develop and execute C language program to read and display key code on LCD.		2
10	Interface POT and 16 x 2 LCD to Atmega8. Develop and execute C language program to read and display data of ADC on LCD.		2
11	Interface 8 bit DAC to Atmega8. Develop and execute C language program to generate triangular waveforms.		2
12	Interface stepper motor to Atmega8. Develop and execute C language program to rotate stepper motor with different speed in clockwise and counter clockwise direction.		2
13	Interface DC motor to Atmega8. Develop and execute C language program to rotate DC motor with different speed in clockwise and counter clockwise direction.		2
14	Build Digital thermometer using LM35 and LCD 16x2.	Mini project	4
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	Overview of Embedded System	04(02)	10(06)	00(00)	14(08)
02	Advance Microcontrollers	02(02)	08(04)	00(00)	10(06)
03	Embedded Development Board (Arduino)	00(00)	04(00)	10(08)	14(08)
04	Communication Protocols	02(00)	08(06)	00(00)	10(06)
05	Interfacing and programming Application Atmega8 using 'C'	00(00)	00(00)	12(08)	12(08)
06	Real Time Operating System	02(00)	04(04)	04(0)	10(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	4	R	2	6	R	2	1	R	2	5/7
	2	R	2																
02	1	U	4	2	U	4	2	U	4	2	U	4	6	U	4				3/5
03	3	U	4	3	A	4	6	A	4	5	A	4	5	A	4				3/5
04	4	U	4	4	U	4	6	U	4	3	A	4	3	A	4				3/5
05	1	U	6	5	A	6	1	U	6										2/3
06	5	A	6	3	A	6	4	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 interfacing diagram, selection of equipment's. writing program, execution etc.	10
2	Performance	20
3	Output Result, Procedure adopted for interfacing (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	-	-
2	-	3	-	-	-	-	-	-	-	3	3	3
3	-	3	-	-	-	-	-	-	-	3	-	-
4	-	3	2	2	-	-	2	2	-	3	-	-
5	-	3	2	2	-	-	2	2	-	3	3	3
6	-	3	2	2	-	-	2	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.	Embedded System Design A Unified Hardware /Software Introduction	Frank Vahid & Tony Givargis, Wiley India Pvt. Ltd., Student Edition 2006	978-0-471-38678-0
2.	Embedded System Architecture, Programming and Design	Raj Kamal, Tata McGraw-Hill Education, 2 nd Edition 2011	978-0-070-66764-8
3.	The Atmega8 Microcontroller and Embedded System Using Assembly and C	Mazidi, Mazidi, McKinlay, PHI, 1 st Edition, 2010	978-81-317-1026-5
4.	Micro C/OS-II The Real Time Kernel	Jean J Labrosse, CMP books U.S.A., 2 nd Edition 2002	978-157820-103-7

5.	Embedded/Real-Time Systems: Concept, Design & Programming	Dr K.V.K.K. Prasad, Dreamtech Press, 1 st Edition 2003	978-8177224610
6.	Microcontrollers (Theory and Applications)	Ajay V. Deshmukh, Tata McGraw-Hill Education, 2005	978-0070585959
7.	The AVR microcontroller and embedded system using assembly and c	Muhammad Ali Mazlidl, Sarmad Naimi, Prentice Hall, 2011	978-0-13-800331-9
8.	Exploring Arduino: Tools and Techniques for Engineering Wizardry	Jeremy Blum, Wiley, 2013	978-1-118-54936-0
9.	Beginning Arduino	Michael McRoberts, Apress, 2 nd Edition 2013	978-1430250166
10.	Beginning Arduino Programming	Brian Evans, Apress, 1 st Edition 2011	978-1430237778

❖ E-REFERENCES:

- <https://www.cse.iitb.ac.in/~cs330/emb-lect.pdf>, assessed on 16th August 2016
- <http://nptel.ac.in/courses/108102045>, assessed on 16th August 2016
- <http://nptel.ac.in/courses/108105057>, assessed on 16th August 2016
- http://www.slideshare.net/murugan_m1/embedded-system-basics?qid=e84c592d-722d-43b6-8ae8-c58dfc2dbc5a&v=&b=&from_search=1, assessed on 17th August 2016
- pet.ece.iisc.ernet.in/course/E2223/Cha1.pdf, assessed on 17th August 2016
- <http://www.engineersgarage.com/articles/rtos-real-time-operating-system>, assessed on 18th August 2016
- <http://arduino.cc>, assessed on 19th September 2016
- <http://www.instructables.com/id/Arduino-Projects>, assessed on 19th September 2016

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION

1. Embedded development board (Arduino Board) – 20 Nos.
2. Open Source IDE for embedded systems (Arduino)
3. Computer System - 20 Nos.
4. Consumable as needed in application suggested by concern Faculty.

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

S.N.	Name	Designation	Institute / Industry
1.	Mr.A. A. Ali	Head of Electronics & Telecomm. Engineering (Shift-II)	Government Polytechnic, Nagpur.

2.	Mr. S. D. Ambade	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
3.	Mr. D.B.Alaspure	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
4.	Mr. V. M. Sakode	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
5.	Mrs. P. H. Gedam	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
6.	Mr. S. V. Darwhekar	Director	Beta Computronics Pvt. Ltd., Nagpur
7.	Mrs. Gazala Ali	HOD in Electronics & Telecomm. Engineering	Anjuman Polytechnic, Nagpur
8.	Mr. S. M. Kale	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Gadchiroli.

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM ENGG.
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: EC502E^{\$}
COURSE TITLE	: VHDL PROGRAMMING
PREREQUISITE	: EC402E
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 (External)
PT	: 01 HR

❖ RATIONALE:

This course is introduced with a view that students will be able to developed digital logic system using VHDL. Students will be studying features of programmable logic devices their specifications for system development. They will be able to develop VHDL code by using CAD tool like text editor, design entry, compiling, simulation, synthesis, analysis, programming etc.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Implement digital logic on programmable logic devices.
2. Develop VHDL source code and test bench for different logic circuit such as adders, multiplexers and counters.
3. Identify the errors in VHDL Source Code.
4. Develop VHDL code for various digital circuits.
5. Compile and Simulate VHDL source code on EDA tool and identify the errors.
6. Synthesize VHDL coded logic system on programmable logic devices like FPGA, CPLD.

❖ **COURSE DETAILS:**
A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Design Methodology.	1. Define terms related to VHDL. 2. State features of FPGA. 3. Draw architecture of CPLD and FPGA. 4. Draw design flow of digital logic system design Using VHDL. 5. Compare FPGA and CPLD. 6. Describe the importance of VHDL in digital logic design.	1.1 Introduction to programmable logic devices CPLD, FPGA. 1.2 FPGA, CPLD - architecture, feature and specifications and applications. 1.3 Introduction to VHDL. 1.4 Basic terms in VHDL, entity declaration, architecture body, configuration declaration, package declaration and package body 1.5 Features and Capabilities of VHDL. 1.6 Design flow and advantages of digital logic system design Using VHDL.	08
2. VHDL design units and basic elements.	1. Define entity and architecture in VHDL. 2. State the significance of VHDL design units, basic elements used in VHDL. 3. Describe different data types and data objects used in VHDL. 4. Describe the importance of different operators used in VHDL.	2.1 Significance and syntax of design units Entity and architecture types – Behavioral, Data Flow, Structural and mix type. 2.2 Syntax and use of configuration, Package, Library. 2.3 Syntax and use of Language Elements 2.3.1 Identifiers. 2.3.2 Data object types. 2.3.3 Data types (subtype, composite, scalar, access). 2.3.4 operators (logical, relational, multiplying, adding and miscellaneous)	08
3. Concurrent Statements.	1. Identify errors in the given VHDL source code. 2. State the use of concurrent signal assignment with the help of example. 3. Describe conditional signal assignment using when else and selected signal assignment with select statement. 4. Describe the use of concurrent statements in behavioral and structural modeling. 5. Develop VHDL code for all basic logic gates, full adder using concurrent statements (dataflow modeling). 6. Develop VHDL code for all types of multiplexers and de multiplexers using with select and when else	3.1 Syntax and Use of 3.1.1 Concurrent Signal Assignment Statement, Multiple drivers. 3.1.2 Conditional Signal Assignment Statement using when else statement. 3.1.3 Selected Signal Assignment Statement using with select. 3.1.4 Block Statement. 3.1.5 Concurrent Assertion Statement 3.1.6 Structural modeling, Component Instantiation, component declaration, port mapping. 3.1.7 Generate statements – for generate, if generate 3.2 VHDL code using with select and when else statement for the following combinational circuits – 3.2.1 Logic gates. 3.2.2 Multiplexers, De multiplexers. 3.2.3 Adders and Sub tractors. 3.2.4 Encoders and Decoders. 3.2.5 Code Converters	16

	statement. 7. Develop VHDL code for all types of encoders, binary to Gray code converter, 4 bit bcd to seven segment decoder, decoders and Odd Parity Generator using data flow modeling. 8. Develop VHDL code EXOR gate using 4:1 Mux and two's complement of 4 bit binary number.	3.2.6 Parity generators. 3.3 Structural modelling examples – 3.3.1 Higher order multiplexers / de multiplexers using lower order. 3.3.2 Higher order adders / sub tractors using lower order.	
4. Sequential Statements	1. State any two differences between concurrent and sequential assignment. 2. Describe the use of process statement in VHDL. 3. Describe the use of wait statement with the help of syntax. 4. Describe variable assignment and signal statement used in VHDL. 5. Develop VHDL code for all types of Flip-Flops using Sequential Constructs. 6. Implement tri state buffers using process statement. 7. Implement registers with Active high clock & asynchronous clear 8. Design 4 bit synchronous binary up/down counter (IC74193) 9. Design 4 bit BCD counter with synchronous reset. 10. Implement 4 bit binary counter with tri-state outputs. 11. Design 4 bit loadable binary counter with asynchronous reset and Synchronous load.	4.1 Concurrent verses sequential signal assignment. 4.2 Syntax and Use of – 4.2.1 Process Statement, types of process statement – combinational, clocked asynchronous reset, synchronous reset. 4.2.2 Variable Assignment Statement. 4.2.3 Signal Assignment Statement. 4.2.4 Wait Statement. 4.2.5 If, if-else, nested if-else statement. 4.2.6 Case Statement. 4.2.7 Null Statement. 4.2.8 Loop Statement, while, for. 4.2.9 Exit Statement. 4.2.10 Next Statement. 4.2.11 Assertion Statement 4.3 VHDL code for following sequential circuits - 4.3.1 Flip flops (D,T,RS,JK) 4.3.2 Counters using behavioral and structural modeling. 4.3.3 Shift Registers. 4.3.4 Tri state buffers.	16
5. Packages and Sub programs	1. State significance of packages and sub program in VHDL. 2. State the syntax of Package body, package declaration, procedures and functions. 3. Describe the use functions and procedures in VHDL	5.1 Significance and syntax of package declaration and package body Subprogram ▪ Procedures, declaration, procedure call statements. ▪ Functions, functional declaration, function call, return statement. 5.2 Comparison of procedure and function 5.3 Examples on packages and sub	08

	with the help of example. 4. Describe package in VHDL with the help of example. 5. Develop VHDL code on packages and sub programs.	programs.	
6. Synchronous sequential circuits. (Finite State Machines)	1. Define state diagram and state table. 2. State the concept of FSM. 3. Describe FSM with the help of block diagram. 4. Develop VHDL code for given MEALY or MOORE type FSM	6.1 Block diagram of FSM. 6.2 Concept of state diagram state table, state assignment. 6.3 VHDL code for MEALY type FSM. 6.4 VHDL code for MOORE type FSM	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Develop VHDL code for all logic gates and simulate using Xilinx tool.	Concurrent Statements	2
2	Develop VHDL code for adder / sub tractor using data flow modeling and simulate using Xilinx tool.		2
3	Develop VHDL code for 8:1 multiplexer / 1:8 decoder using when else statement and simulate using Xilinx tool.		2
4	Develop VHDL code for 8:3 encoder / 3:8 decoder using with select statement and simulate using Xilinx tool		2
5	Develop VHDL code for 7 Bit Odd / Even Parity Generator. and simulate using Xilinx tool		2
6	Design 4 bit adder using 1 bit adder using structural modeling.		2
7	Design 4 bit BCD to GRAY code converter using VHDL. Analyze the results.		2
8	Develop VHDL code tri state buffer using process statement. Apply the test inputs and analyze the waveforms.	Sequential Statements	2
9	Develop VHDL code for D flip-flop with asynchronous reset. Apply the test inputs and analyze the waveforms.		2
10	Develop VHDL code for JK flip-flop with synchronous reset. Apply the test inputs and analyze the waveforms.		2
11	Develop VHDL code for 4 bit UP counter. Apply the test inputs and analyze the waveforms.		2
12	Develop VHDL code for 4 bit DOWN counter using T flip flop. Apply the test inputs and analyze the waveforms.		4
13	Develop VHDL code for Mealy / Moore FSM to detect the sequence 1101(overlapping allowed).	Synchronous sequential circuits. (Finite State Machines)	4
Skill Assessment			02
Total Hours			32

❖ SPECIFICATION TABLE FOR THEORY PAPER

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to Design Methodology.	02(04)	04(00)	00(00)	06(04)
02	VHDL design units and basic elements.	02(00)	06(04)	00(00)	08(04)
03	Concurrent Statements	02(00)	08(04)	08(06)	18(10)
04	Sequential Statements	02(00)	08(04)	10(06)	20(10)
05	Packages and Sub programs.	02(00)	06(04)	00(04)	08(08)
06	Synchronous sequential circuits.	00(00)	04(04)	06(00)	10(04)
	Total	10(04)	36(20)	24 (16)	70 (40)

❖ 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	1	R	2	5/7
	1	R	2																
02	1	U	4	3	U	4	3	A	4	2	U	4	3	U	4				3/5
03	3	U	4	3	A	4	4	A	4	4	U	4	5	A	4				3/5
04	4	U	4	4	U	4	6	U	4	5	U	4	6	U	4				3/5
05	2	U	6	4	A	6	3	A	6										2/3
06	5	U	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 logic diagram and writing VHDL code on paper.	10
2	Coding and simulation on Xilinx software.	20
3	Verification of code using test cases.	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	-	-
4	-	3	3	3	-	-	2	2	-	3	2	2
5	-	3	3	3	-	-	2	2	-	3	2	2
6	-	3	3	3	-	-	2	2	-	3	2	2

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

❖ REFERENCE & TEXT BOOKS:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	VHDL Primer	Jayaram Bhasker, Prentice Hall India, Third Edition, 1999	13: 0076092030843 10: 0130965758
2.	Fundamental Of Digital Logic With VHDL Design	Stephen Brown- Zvonko Vranesic, Tata Mc Graw Hill, third Edition, 2012	13: 9780070647756 10: 0070647755
3.	VHDL: Programming By Example	Douglas Perry, Tata McGraw Hill 4 th Edition, 2002	13: 978-0071400701 10: 0071400702
4.	Digital System Design with VHDL	Mark Zwolinski, Prentice Hall, Second Edition, 2004	13 : 9780130399854 10 : 013039985X,

❖ **E-REFERENCES:**

- [http:// www.Xilinx.com](http://www.Xilinx.com) , assessed on 18th January 2016
- <http://web.ewu.edu/groups/technology/Claudio/ee430/Cad/AccoladeVHDLref.pdf>, assessed on 18th January 2016

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

- 1) Latest Desktop Computer
- 2) EDA tool (open source) or Xilinx demo version for coding and simulation.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Prof. S. S. Tadas	Head of Department	Government Polytechnic, Nagpur.
2.	Prof. D. A. Brahmanekar	Lecturer	Government Polytechnic, Nagpur.
3.	Prof. V M Sakode	Lecturer	Government Polytechnic, Nagpur.
4.	Shri. Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
5.	Mr. S. M. Kale	Lecturer in Electronics	Govt. Polytechnic, Gadchiroli
6.	Mrs. Gazala. Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.

LEVEL NAME : ELECTIVE COURSES

COURSE CODE : EC503E^{\$}

COURSE TITLE : CONTROL SYSTEM

PREREQUISITE : EC404E

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 (External)

PT. EXAM : 01 HR

❖ **RATIONALE:**

The development of technology has seen a wide use of automatic control system to improve the quantity and quality of manufactured products in many domestic, industrial and defence applications. To increase the effectiveness, efficiency and quality of products, now a days it is very much essential to complete the required work or task automatically in every field. As the control system is the basis of various automatic control systems, therefore the students of electronic engineering must have the knowledge of control system.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to

1. Develop the mathematical models for a given physical system to study its properties.
2. Evaluate the properties of the overall systems by using its model
3. Analyze the behavior of closed loop systems using tools such as root locus, Routh Hurwitz, Bode plot
4. Design controller for a specific application
5. Simulate different systems using software's to find its stability
6. Interpret the Bode plot, Root locus plot etc.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Introduction Of Control System	1. Define open loop and closed loop system. 2. Draw block diagrams of different systems 3. Describe working of different servo components 4. Compare armature controlled and field controlled DC servo motors 5. Describe the different control systems 6. Analyse different control systems	1.1 Definitions of control system. 1.2 Block diagram of control system. 1.3 Classification of control systems. 1.4 Definition, block diagram, practical example and Comparison of open loop & closed loop control system. 1.5 Advantages, disadvantages of Open loop and Closed loop control systems. 1.6 Transfer function of Open loop control system and closed loop control system. Derivation of transfer function for close loop control system. 1.7 Servo system –definition, block diagram, 1.8 AC & DC servo systems- comparison, schematic diagram , concept and principle 1.9 Servo components: a) Potentiometer as error detector b)Synchro as error detector 1.10 DC servo motor- characteristic, difference from a normal DC motor, comparison between armature controlled and field controlled DC servo motors(no TF) 1.11 AC servo motor-difference from a normal 2 phase induction motor, characteristic of AC Servo meter 1.12 Block diagram of DC and AC position control system	10
2. Mathematical Models Of Physical System	1.Evaluate the transfer function for given system 2.Construct the signal flow graph for given circuit/system 3.Draw block diagram from signal flow graph	2.1 Introduction of mathematical models of physical system 2.2 Differential equation of the physical system. 2.3 Modeling of mechanical system,	10

	4. Find the closed loop transfer function from signal flow graph/block diagram reduction technique	Translational system, Rotational system 2.4 Free Body diagram of mass, spring, dashpot system 2.5 Modeling of electrical system 2.6 Block diagram reduction technique 2.7 Signal flow graphs, Mason's gain formula. 2.8 Numerical based on above topic	
3. Time Domain Analysis	1. Define different time response specifications 2. State the formulas for different time response specifications 3. Draw time response of first/second order system 4. Describe first /second order system 5. Analyse time response of various systems 6. Analyse Type 0, Type 1 and Type 2 system 7. Calculate steady state error and error constants	3.1 Introduction of time domain analysis. 3.2 Standard test signal: step signal, ramp signal, and parabolic signal- Mathematical representation and Laplace transform 3.3 Time response of first order system for step input. 3.4 Time response of second order system for step input. 3.5 Time response specification(No derivations) Tp ,Ts, Tr, Td, Mp,ess 3.6 Formulas for the time response of second order system. 3.7 Poles & zeros – definition, S-plane representation 3.8 Types of feedback control system: type 0 system, type1 system and type2 system. 3.9 Steady state error and error constants. 3.10 Control actions: discontinuous & continuous modes; 3.11 On off controllers: neutral zone 3.12 Proportional controllers (offset, proportional band) integral & derivative controllers; 3.13 Composite controllers; PI, PD, PID controllers 3.14 Numericals based on above topic	14
4. Concept Of Stability	1. Define different types of stability 2. State the conditions for stability 3. Describe special cases	4.1 Definition of stability. 4.2 Necessary condition for stability. 4.3 Types of stability (relative, absolute, conditional). 4.4 Characteristic equation for stability.	12

	Rouths stability criterion - Determine stability of system using Hurwitz/ Rouths criterion - Find gain K for system to be stable	4.5 Root locations in S-plane for stable and unstable systems. 4.5 Hurwitz stability criterion. 4.6 Rouths stability criterion. 4.7 Conditions and Special cases for Rouths stability criterion. 4.8 Application of the Rouths stability criterion to linear feedback Numericals on Rouths stability criterion	
5. Root Locus Techniques	- State different rules to construct root locus - Define different terms related to root locus - Sketch root locus for a given transfer function - Analyse the given root locus	5.1 Introduction of the root locus concept 5.2 Construction of root loci. 5.3 Construction Rules 5.4 Definition of Asymptotes, Centroid, Breakaway point, Angle of departure, Angle of arrival. 5.5 Numericals based on above topic	10
6 . Bode Plot Method	- Define different terms related to Bode plot - Describe Gain plot/phase plot - Draw the Bode plot from for given transfer function - Analyse the Bode plot	6.1 Introduction of Bode plot. 6.2 Gain plot, Phase plot. 6.3 Poles and zeros on the real axis, Complex conjugate pole. 6.4 General procedure for constructing Bode plot. 6.5 Plotting of Gain margin and Phase margin 6.6 Numerical based on above topic	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Plot the response of potentiometer as error detector	Introduction Of Control System	2
2	Plot the variation in output position with respect to input position for synchro as error detector		2
3	Measure and Control error of angular position with DC position control system		4
4	Design an electronic PI controller and plot its time response	Time Domain Analysis	2
5	Connect RC circuit(first order system) to CRO and plot its step response .		2
6	Measure time response specifications ie T_p , T_s , T_r , T_d , M_p , σ for second order system(RLC circuit) by plotting the time response.		4
7	Measure the steady state error of type – 1/type 2 first order system		2
8	Derive the open loop and closed loop poles and zeros for varieties of the systems. Draw their Pole-zero map and check the system stability.	Concept Of Stability	4
9	Plot root locus for a given system using matlab/Scilab. and derive the value of gain from Root Locus for system marginal stability.	Root Locus Techniques	4
10	Plot Bode plot for a given system using Matlab/Scilab. Derive Gain margin , Phase margin and stability from the plot.	Bode Plot Method	4
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	Introduction Of Control System	02(00)	06(06)	04(00)	12(06)
02	Mathematical Models Of Physical System	02(00)	08(00)	00(06)	10(06)
03	Time Domain Analysis	04(00)	06(08)	04(00)	14(08)
04	Concept Of Stability	02(02)	04(04)	06(00)	12(06)
05	Root Locus Techniques	02(00)	04(04)	06(04)	12(08)
06	Bode Plot Method	04(00)	06(00)	00(06)	10(06)
	Total	16(02)	34(22)	20 (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	2	R	2	4	R	2	5	R	2	6	U	2	1	U	2	5/7
	4	R	2																
02	1	A	4	2	U	4	3	A	4	4	U	4	3	U	4				3/5
03	2	U	4	4	U	4	5	U	4	5	A	4	1	U	4				3/5
04	6	R	4	3	R	4	6	U	4	5	U	4	3	U	4				3/5
05	1	U	6	3	U	6	2	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 block diagram/circuit diagram, selection of equipment's. writing procedure etc. Or Define problem/Write commands etc	10
2	Performance/Simulation	20
3	Calculation, Result, Drawing Graphs(if any)	10
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
2	-	3	-	-	-	-	-	-	-	3	-	3
3	-	3	-	-	-	-	-	-	-	3		3
4	-	3	2	2	-	-	-	2	-	3	2	3
5	-	3	2	2	-	-	-	2	-	3	2	3
6	-	3	2	2	-	-	-	2	-	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.	Control System Engineering	I.J. Nagarath and M. Gopal, John Wiley and Sons, 5 TH Edition , 2000	13: 978-1848290037
2.	Automatic Control Systems	B.C. Kuo, Prentice Hall of India, Edition, 1990	13: 05 5070-1
3.	Modern control engineering,	K. Ogata, Prentice Hall of India, 2 nd Edition, 1990	13: 978-9813026940
4.	Control System Analysis and Design	K. K. Agrawal, Khanna Publishers, Edition,1994	8174092571
5.	Feedback and Control System	Joseph J Distefano III et al., Schaum's Outlines, Tata Mcgraw Hill, 2 nd Edition, 2007.	9780071829489
6.	Principles of Control Systems	S P Xavier Eugene, J Joseph Cyril Babu , S. Chand & Company Pvt. Ltd, Edition,2006	9788121917780 8121917786

❖ **E-REFERENCES:**

- https://www.youtube.com/watch?v=vVFDm_CdQw , assessed on 18th September 2016
- <http://nptel.ac.in/courses/108101037/31> assessed on 18th September 2016
- <http://nptel.ac.in/courses/108101037/24> assessed on 18th September 2016
- <http://engineeringppt.blogspot.in/2011/08/control-systems.html> assessed on 18th September 2016

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

1. Digital Multi-meter 3.5 digit with R , V, I measurements, diode and BJT testing
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based
Bandwidth 20 MHz/30 Mhz
3. Function Generator 1 MHz , sine, square, triangular, ramp and pulse generator Freq range 0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
4. Regulated Power Supply 0- 30 Volt, 2 A with digital display

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mr. A.A. Ali	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mrs M N Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mrs. P. F. Dorlikar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5.	Mr. Sandip V Darwhekar	Director	Beta computronics Pvt Ltd Nagpur
6.	Mrs Gajala Ali	Head of Electronics Engg	Anjuman Polytechnic , Nagpur
7.	Mr. S. M. Kale	Lecturer, Electronics Engg.	Government Polytechnic, Gadchiroli.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS AND TELECOMM. ENGG.

LEVEL NAME : ELECTIVE COURSES

COURSE CODE : EC504E^{\$}

COURSE TITLE : PROCESS INSTRUMENTATION

PREREQUISITE : EC407E

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 (External)

PT. : 01 HR

❖ **RATIONALE:**

Instrumentation and control systems forms a major part of a production or process industry setup. This course will enable the students to evaluate the complexity of different process variables in industry, which includes different process measuring instruments and related transducers. Students will appreciate the importance and limitation of different types of process controls and actual control.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Justify Need of Controllers.
2. Outline the selection criteria of PLC.
3. Select Fuzzy logic controller and SCADA System.
4. Develop small Logic programs for PLC.
5. Design ladder logic diagram for various systems.
6. Recognize different input and output modules of PLC.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Introduction to Process Control and Instrumentation	1. List advancements in process control 2. List Advantages of automatic process control system 3. Identify types of Automatic Process Control 4. Draw a block diagram of a simple process-control loop and identify each element of process 5. State need of Automatic Process Control.	1.1 Recent advancements in process control. 1.2 Overview of process control 1.3 Hydraulic, pneumatic and electronic control. 1.4 Automatic Process Control: 1.4.1 Need of automatic process control elements of process control 1.4.2 Advantages of automatic process control system 1.4.3 Types of Automatic Process Control	06
2. Control Actions	1. Recognize the common P&ID symbols. 2. State need of control Actions 3. Describe different modes of process control system 4. Describe concept of manual, on-off, proportional, integral and derivative mode 5. Interpret Response of different control modes 6. Differentiate between different types of Control actions 7. Describe composite controllers 8. Describe Tuning methods of controllers	2.1 Need of Control Actions 2.2 Discontinuous modes 2.2.1 ON OFF controllers: equation, neutral zone 2.3 Continuous modes 2.3.1 PROPORTIONAL controllers (offset, proportional band), 2.3.2 INTEGRAL & DERIVATIVE controllers (output equations, corresponding Laplace Transforms 2.3.3 Response of P,I & D controllers 2.4 Composite controllers 2.4.1 PI, PD, PID controllers (output Equations, Response, Comparison) 2.5 Relative merits and Demerits 2.6 Tuning methods of controllers	10
3. PLC Fundamentals	1. Identify different blocks from Internal architecture of PLC 2. Identify different input and output modules of PLC	3.1 Evolution of PLC in automation 3.2 Need and benefits of PLC in Automation 3.3 Overview of PLC 3.4 Internal architecture of PLC	10

	3. List different PLC operation modes 4. List Applications of PLC. 5. State Need and benefits of PLC in Automation 6. Describe Selection criteria of PLC 7. State the function of input modules 8. State the function of input modules 9. Describe Fixed and Modular PLCs 10. Compare Fixed and Modular PLCs	3.4.1 CPU – function, scanning cycle, speed of execution 3.4.2 Power supply – function, Block diagram 3.4.3 Memory – function & organization of ROM & RAM 3.4.4 Input modules – function, diff. Input devices used with PLC (only name & their uses) 3.4.5 Output modules – function, diff. output devices used with PLC (only name & their uses) 3.5 Fixed and Modular PLCs 3.6 Selection criteria of PLC 3.7 PLC operation modesApplications of PLC	
4. PLC Hardware & Programming	1. List specifications of AC input/output modules & DC input/output modules. 2. State Sinking and sourcing concept in DC input modules 3. Draw ladder diagrams to program PLC 4. Differentiate different I/O modules of PLC. 5. Describe Analog input and output modules 6. State I/O addressing of PLC 7. Develop PLC program for Bit, Logical, Timers, Counter, Compare, Mathematical, Move, Program Control, Trigger function operations using ladder programming logic. 8. Describe block diagram, working and operation of PLC for control of process tank and conveyor motor	4.1 Discrete input modules 4.1.1 Block diagram, typical wiring details and specifications of AC input modules & DC input module. 4.1.2 Sinking and sourcing concept in DC input modules 4.2 Discrete output modules 4.2.1 Block diagram description, typical wiring details and specifications of AC output module & DC output modules 4.3 Analog input and output modules 4.3.1 Block diagram, typical wiring details and specifications 4.4 Ladder logic diagram 4.5 PLC Instruction set 4.5.1 I/O addressing of PLC 4.5.2 Bit Instructions 4.5.3 Logical instruction 4.5.4 Timers instructions 4.5.5 Counter instructions 4.5.6 Compare instructions 4.5.7 Mathematical instructions 4.5.8 Move instructions 4.5.9 Program Control instructions 4.5.10 Trigger function instructions	20

		4.6 PLC programming examples based on above instruction using Ladder programming language 4.7 Block diagram, working and operation of PLC for control of process tank and conveyor motor	
5. Supervisory Control and Data Acquisition System(SCADA)	1. Identify Types of SCADA 2. Identify Applications of SCADA systems 3. Draw Block diagram of SCADA 4. State Features of SCADA 5. State Significance of SCADA 6. Describe Selection criteria of SCADA	5.1 Block diagram of SCADA, 5.2 Remoteterminal unit(RTU) 5.3 Features of SCADA 5.4 Significance of SCADA 5.5 Selection criteria of SCADA 5.6 Types of SCADA 5.7 Distributed SCADA system 5.8 Applications of SCADA systems	10
6. Fuzzy Logic Controller (FLC)	1. Identify basic configuration of closed loop system involving FLC 2. Draw block diagram of Fuzzy logic controllers 3. State function of each block 4. Describe Concept of Fuzzy logic 5. Draw fuzzy logic control in fully automatic washing machine	6.1 Concept of Fuzzy logic 6.2 Block diagram of Fuzzy logic controllers , function of each block 6.3 Basic configuration of closed loop system involving FLC 6.4 Triangular membership function. 6.5 Application of fuzzy logic control in fully automatic washing machine (only block diagram)	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Prepare report of survey on different types of PLC's available in market.	PLC Fundamentals	2
2	Develop and Execute PLC programs for following logic in LAD using open source software. (a) Bit Instructions (b) Logical instruction (c) Timers instructions (d) Counter instructions (e) Compare instructions (f) Mathematical instructions (g) Move instructions	PLC Hardware & Programming	2
3	Develop and Execute ladder logic program for ON-OFF control of lamp by using PLC.		2
4	Develop and Execute ladder logic program for lamp ON and OFF using timer and counter by using PLC.		2
5	Develop and Execute ladder logic program for stepper motor by using PLC		2
6	Develop and Execute ladder logic program for temperature controller by using PLC		4
7	Develop and Execute ladder logic program for traffic lights indication.		4
8	Design ladder logic program for bottling plant.		4
9	Prepare visit report on any two applications of SCADA system in various fields.	Supervisory Control and Data Acquisition System (SCADA)	4
10	Draw block diagram of fuzzy logic control in fully automatic washing machine using MATLAB.	Fuzzy Logic Controller (FLC)	4
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	Introduction to Process Control and Instrumentation	02(00)	04(04)	00(00)	06(04)
02	Control Actions	02(00)	04(06)	04(00)	10(06)
03	PLC Fundamentals	02(00)	10(00)	00(06)	12(06)
04	PLC Hardware & Programming	02(00)	04(08)	16(04)	22(12)
05	Supervisory Control and Data Acquisition System(SCADA)	02(00)	10(04)	00(04)	12(08)
06	Fuzzy Logic Controller (FLC)	00(04)	04(00)	04(00)	08(04)
	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	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	5/7
	6	R	2																
02	1	U	4	2	U	4	3	U	4	1	U	4	4	U	4				3/5
03	4	U	4	5	U	4	6	U	4	4	U	4	4	A	4				3/5
04	2	A	4	4	A	4	6	A	4	5	U	4	5	A	4				3/5
05	3	U	6	4	A	6	2	U	6										2/3
06	4	A	6	5	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
		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 ladder diagram, selection of equipment's. writing program, execution etc.	10
2	Performance	20
3	Output Result, Procedure adopted for PLC programing (if any)	10
5	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
4	-	3	2	2	-	-	2	2	-	3	2	3
5	-	3	2	2	3	-	2	2	-	3	2	3
6	-	3	2	2	3	-	2	2	-	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.	Process Control Instrumentation Technology	C. D. Johnson, John Wiley & Sons, 3 rd Edition 1988	978-0471853404
2.	Programmable logic Controllers	F. D. Petruzella, Tata-McGraw Hill, 4 th Edition 2010	978-0-07-351088-0
3.	Industrial instrumentation & control	S. K. Singh, Tata-McGraw-Hill, 3 rd Edition 2009	978-0-07-026222-5
4.	Introduction to programmable logic controllers	Garry Dunning, Thomson, 3rd Edition 2005	978-1401884260
5.	Programmable logic controllers	W. Bolton, Newnes-Elsevier, 5 th Edition 2009	978-1856177511
6.	SCADA: Supervisory Control and Data Acquisition System	Stuart A. Boyer, ISA, 4th Edition 2009	978-1936007097

7.	Fuzzy Logic with Engineering Applications	Timothy J. Ross, A John Wiley and Sons Ltd. Publication, 3 rd Edition 2010	978-0-470-74376-8
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❖ **E-REFERENCES:**

1. <http://nptel.ac.in/courses/112102011/11>, assessed on 18th September 2016
2. <http://nptel.ac.in/courses/112102011/12>, assessed on 18th September 2016
3. <http://www.slideshare.net/rishabhshrivastava90857/an-introduction-to-scada>, assessed on 18th September 2016
4. <http://www.edgefxkits.com/blog/scada-system-architecture-types-applications/>, assessed on 18th September 2016
5. www.eng.unideb.hu/userdir/deak.krisztian/BOOK.pdf, assessed on 18th September 2016
6. www.lu.lv/materiali/apgads/raksti/756_pp_193-203.pdf, , assessed on 18th September 2016

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

1. PLC Trainer setup 05Nos.
2. WinTRiLOGI/ABB PLC simulator open source software.
3. Computer System - 20 Nos.
4. Consumable as needed in application suggested by concern Faculty.

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. D. Ambade	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
2.	Mr. V. M. Sakode	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
3.	Mrs. P. H. Gedam	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur.
4.	Mr. S. V. Darwhekar	Director	Beta Computronics Pvt. Ltd., Nagpur
5.	Mrs. Gazala Ali	HOD in Electronics & Telecomm. Engineering	Anjuman Polytechnic, Nagpur
6.	Mr. S. M. Kale	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Gadchiroli.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS AND TELECOMM. ENGG.

LEVEL NAME : ELECTIVE COURSES

COURSE CODE : EC505E\$

COURSE TITLE : OPTICAL COMMUNICATION

PREREQUISITE : EC403E

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 (External)

PT. : 01 HR

❖ **RATIONALE:**

Fiber optics technology is increasingly replacing conventional wire-transmission lines. Realizing its fast growing importance, the electronics engineering must know the basic principles of fiber optics communication system. Therefore this course is introduced. This course deals with basic principles and applications of fiber optics, its transmission, sources and detectors.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply the fundamental principles of optics and light wave to design optical fiber communication systems.
2. Analyze the types of optical fiber
3. Use the concepts of optical communication for different applications.
4. Measure attenuation and various losses in optical fiber communication.
5. Identify different types of connectors in optical fiber communication.
6. Prepare a visit report.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1.Light Waves And Basics Of Optical Fiber	1. Define Electromagnetic spectrum. 2. Identify spectrum for optical communication. 3. Describe the block diagram of optical communication. 4. Define Numerical aperture. 5. Derive equation for numerical aperture. 6. Apply concept of acceptance angle, acceptance cone and NA to solve numerical 7. Estimate the values of NA using formula.	1.1.Electromagnetic spectrum and optical spectral bands 1.2 Basic optical laws and definitions. 1.3 Basics of light and its quantum nature. 1.4 Block diagram of optical communication (analog and digital). 1.5 Advantages and disadvantages of optical communication 1.6 Applications of optical communication 1.7 Propagation of light in an optical fiber. 1.8 Total internal reflection, acceptance angle, numerical aperture (NA) and derivation of NA . 1.9 Phase and group velocity, cutoff wavelength and group delay. 1.10 Numerical on NA, acceptance angle and critical angle	12
2.Classification Of Optical Fibers	1.Classify different types of fibers. 2.Draw step index fiber diagram. 3.Describe Graded index Fiber. 4.Define single mode and multimode fibers. 5.Compare different types of fibers.	2.1 Basics of Optical fiber structure 2.2. Classification of optical fibers according to material used, refractive index profile. 2.3 Step index fiber and graded index fiber. 2.4 single mode and multimode fibers .	06
3.Fiber Losses And Dispersion In Optical Fiber	1. Distinguish different losses in optical communication. 2. Describe various losses in optical communication. 3. Describe Bending loss. 4. Compare Micro bending and macro bending loss. 5. Distinguish between intramodal and intermodal dispersion. 6. Describe chromatic dispersion.	3.1 Signal degradation in optical fiber. 3.2 Attenuation, attenuation units. 3.3 Numericals on signal attenuation. 3.4 Material Absorption losses in optical fiber. 3.5. Intrinsic absorption and extrinsic absorption. 3.6. Linear Scattering losses and Nonlinear Scattering losses. 3.7 Rayleigh Scattering and Mie Scattering 3.8. Fiber bends loss. Types: - Macro	12

	7. Define Maximum transmission rate. 8. Compare different dispersion.	bends and Micro bend losses. 3.9. Material or impurity losses. Leaky modes. 3.10. Radiation induced losses, transmission losses Inherent defect losses, temperature dependence of fiber losses, core and cladding losses. 3.11 Dispersion, signal distortion in optical fibers. 3.12 Types of dispersion:- Intra modal dispersion(chromatic dispersion) and Intermodal dispersion 3.13 Types of intra modal dispersion:- material dispersion and waveguide dispersion 3.15 Total dispersion delay, maximum transmission rate, modal noise.	
4. Optical Sources And Transmitters.	1. Define Spontaneous and stimulated emission. 2. Recall basics of semiconductor physics. 3. Describe Principle working of LED. 4. State the working principle of LASER. 5. Describe operation of LASER. 6. Compare between LASER and LED. 7. Draw block diagram of LED transmitter. 8. Draw block diagram of LASER transmitter.	4.1 Light emission – spontaneous emission, stimulated emission, forbidden energy gap. 4.2 Basics of semiconductor physics:- Energy bands, direct and indirect band gaps, pn junction, light source materials. 4.3 Introduction to optical sources:- wavelength and material consideration 4.4 Light emission theory:- stimulated emission, spontaneous emission. 4.5 LED:- principle of working and characteristic 4.6 Concept of DH-LED. 4.7 Types of LED: Surface emitter LED and edge emitter LED, working principle of these LEDs 4.8 Advantages and disadvantages of LED 4.9 Principle working of semiconductor injection LASER and its characteristics. 4.10 Comparison of LED and LASER 4.11 LED transmitter circuit for analog and digital signals. 4.12 LASER transmitter circuit for analog and digital signals	13

5. Optical Detectors And Receivers	1. State detection principle. 2. Define Dark current noise, thermal noise. 3. State Photo emissive, photo conductive and photo voltaic principle 4. State the need of repeater. 5. Compare Photodiodes. 6. Draw block diagram of optical receiver and Describe	5.1 Requirements for detectors and materials used 5.2 Optical detection principle 5.3 Photo emissive, photo conductive and photo voltaic principle 5.4 Principle working characteristic of p-n diode, PIN photodiode and Avalanche photo diode (APD) 5.5 Comparison of above photodiodes 5.6 Fundamental Receiver operation, digital signal transmission 5.7 Receiver noise; thermal noise, dark current noise and quantum noise 5.8 Block diagram of optical receiver circuit using APD and PIN photodiode 5.9 Need of repeater	10
6. Optical Components And Measurements.	1. List types of Couplers 2. Define Splicing. 3. State types of Splicing 4. Describe splicing techniques. 5. State the concept of integrated optics. 6. Categorize optical measurement equipment. 7. Describe OTDR	6.1 Different optical components like coupler and its types: directional coupler, star coupler 6.2 Splicing and its types: electric arc fusion splicing and mechanical splicing 6.3 Connectors 6.4 Concepts of integrated optics and optical amplifiers 6.5 Time and power budget 6.6 Introduction to optical measurement 6.7 Equipment used in field testing 6.8 Optical power method, cutback method, insertion loss method, analysis using OTDR	11
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Observe the input and Output waveforms on CRO by using 650nm optical fiber as a analog link	Light waves and basics of optical fiber	2
2	Observe the Input and Output waveforms on CRO by using 650nm optical fiber as a digital link		2
3	Measure the value of NA and observe the effect of diameter of optical fiber on NA values.	Light waves and basics of optical fiber	2
4	Measure the loss occurred due to bending of fiber using Optical power meter	Fiber losses and dispersion in optical fiber	2
5	Measure Propagation loss or Attenuation loss in an optical fiber by measuring input voltage and output voltage.	Fiber losses and dispersion in optical fiber	2
6	Set up a voice communication link through optical fiber using amplitude modulation	Optical sources and transmitter	2
7	Observe the effect of intensity modulation of analog signal by transmitting it over optical fiber cable and demodulate the same at the receiver.	Optical sources and transmitter	2
8	Identify various connectors used for optical communication system	Optical Components and Measurements	2
9	Perform mechanical splicing for connecting two optical fibers	Optical Components and Measurements	2
10	Measure propagation loss by using optical power meter	Optical Components and Measurements	2
11	Prepare Report on Visit to optical fiber section at BSNL office		6
12	Prepare Report on Various Optical Couplers and connectors		4
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	Light waves and basics of optical fiber	04(02)	04(04)	06(00)	14(06)
02	Classification of optical fiber	02(02)	08(04)	00(00)	10(06)
03	Fiber losses and dispersion in optical fiber	02(04)	04(04)	06(00)	12(08)
04	Optical sources and optical transmitter	04(04)	08(04)	00(00)	12(08)
05	Optical Detector and receivers	06(00)	06(06)	00(00)	12(06)
06	Optical components and measurements	00(00)	04(00)	06(06)	10(06)
	Total	18(12)	34(22)	18 (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	3	R	2	5	R	2	2	R	2	5/7
	1	R	2																
02	1	U	4	2	U	4	2	U	4	4	U	4	1	U	4				3/5
03	3	U	4	4	R	4	4	U	4	4	R	4	2	R	4				3/5
04	4	U	4	5	R	4	6	U	4	3	R	4	3	U	4				3/5
05	1	A	6	3	A	6	5	U	6										2/3
06	6	A	6	5	U	6	6	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESMENT 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, writing observation table ,draw waveforms and writing procedure etc.	10
2	Performance of the practical	20
3	Taking observations ,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	-
2	-	3	3	-	-	-	-	-	-	3	3	-
3	-	3	3	-	-	-	-	3	-	3	3	-
4	-	3	3	2	-	-	-	3	-	3	3	2
5	-	3	3	2	-	-	-	3	-	3	3	2
6	-	3	3	2	-	-	1	3	-	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.	Optical fiber communication	Gerd Keiser, McGraw hill education (India) pvt. Ltd. 2008	9780072321012
2.	Optical Fiber communication	John M. Senior, Pearson education ltd,2009, 3rd edition	9788131732663

❖ **E-REFERENCES:**

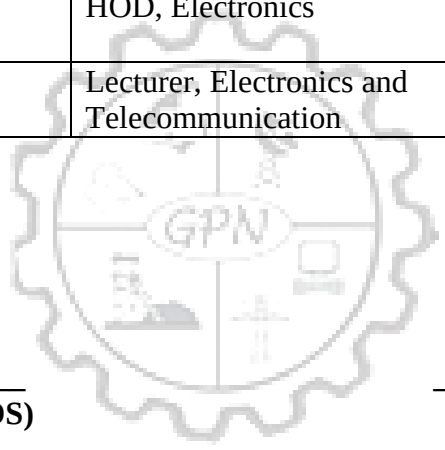
- <http://nptel.ac.in/courses/117104127> , assessed on 25th September, 2016
- <http://www.electronicsforu.com> , assessed on 25th September, 2016
- <https://www.youtube.com/watch?v=7h2xr-pi5VQ> , assessed on 25th September, 2016

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

- Digital Multi-meter
- Cathode Ray Oscilloscope (0-50 MHZ)
- Function Generator

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. S. S. Tadas	HOD, Electronics and Telecommunications	Government Polytechnic, Nagpur.
2.	Mr. D. A. Brahmanekar	Lecturer	Government Polytechnic, Nagpur.
3.	Mrs. U. P. Potdar	Lecturer	Government Polytechnic, Nagpur.
4.	Mr. Sandip V. Darwhekar	Director	Beta Computronics pvt. Ltd. Nagpur
5.	Mrs. Gazzala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur
6.	Mr. S. M. Kale	Lecturer, Electronics and Telecommunication	Government Polytechnic, Gadchiroli



(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMM. ENGG.
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: EC506E ^s
COURSE TITLE	: COMPUTER COMMUNICATION NETWORK
PREREQUISITE	: EC403E
TEACHING SCHEME:	TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2CLOCK HR.)
TH TEE	: 03 HRs
PR TEE	: 02 HRs(External)
PT EXAM	: 01 HR

❖ 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. This knowledge explores the student for understanding current network management technology.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze network architecture to connect computers in network.
2. Apply the different types of network topologies for internet connection
3. Identify various transmission media for data transfer in computer network.
4. Install/configure printer, server, Networking device, TCP/IP protocol.
5. Connect computer terminal in various physical topologies.
6. Test data transfer/ Networking devices

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Concept of data communication	1. Define data communication & its type 2. State the components of data communication 3. Describe signal Propagation for data communication 4. Describe Bandwidth of signal, medium, and Data transmission rate.	1.1 Definition of data communication & its type- Local and Remote 1.2 Basic concept of Components of data communication-Message, sender, Receiver,. 1.3 Medium Signal Propagation 1.4 Definition and waveform of Analog and Digital signals. 1.5 Bandwidth of a signal and a medium 1.6 Data transmission rate and bandwidth.	08
2. Basic network concepts	1. Define computer network. 2. Describe fundamental of computer networks. 3. Describe the various Benefits of computer network. 4. Classify computer network Base on Geography, component role 5. Identify different components of network. 6. Design peer-to- peer network for data transfer.	2.1 Fundamentals of Computer Network- Definition, Need of Computer Network Applications, Component of Computer Network. 2.2 Network Benefits- Sharing Information-File Sharing, E-mail Sharing Resources- Printer Sharing, Application Services Facilitating Centralized Management- Managing Software, Maintaining the Network, Backing up data 2.3 Computer Network Classifications-Classification of Network by their Geography.- PAN, CAN, LAN, MAN, WAN Classification of Network by their Component Role Peer-to-Peer Network, Server-Based Network	14
3. Network topologies & networking devices	1. Define various topologies with selection criteria. 2. Describe the network control device with their need. 3. Describe the role of Network control device in connector, Hub, Repeaters,	3.1 Network Topologies - Introduction, Definition, Selection Criteria, 3.2 Types of Topology- Bus topology Ring topology, Star topology Mesh topology	10

	Bridge, switch, Router, Gateway and modem 4. Describe NIC device driver software and Client server software. 5. Design a computer Network considering particular Topology.	Tree topology Hybrid topology 3.3 Network Control /Connecting Devices-Need of Network Control devices 3.4 Role of Network Control devices in a Network, Connectors, Hub, Repeater, Bridges, Switches, Router, Gateway, Modem. 3.5 Network Software, NIC device driver, Client – Server software – example -ftp,telnet	
4. Transmission media	1. List guided and unguided transmission media 2. Describe characteristic of each cable. 3. Develop the various latest technologies in wireless networks and cellular telephony. 4. Identify different cables and connectors for data transmission 5. Select appropriate transmission media for a given network.	4.1 Introduction - Need of Transmission Media, Selection Criteria. 4.2 Types of Transmission Media 4.3 Guided Media: Cable 4.4 Characteristics, Types of Cable- Twisted Pair Cable, Co-axial Cable, Fibre Optic Cable. 4.5 Unguided media: Types of Communication Band- Microwave Communication, Radio wave Communication, Satellite Communication, Infrared Communication. 4.6 Latest Technologies in Wireless Network-Bluetooth Architecture, Wi-Fi, Wi- Max. 4.7 Cellular Telephone - Band in Cellular Telephony, Calls using Mobile Phones, Transmitting receiving / Handoff operations.	14
5. OSI Reference Model	1. List various Layers of OSI reference model. 2. Describe layered Architecture of OSI model. 3. Describe the function of each layer & protocols used. 4. Identify various layers of OSI model	5.1 Introduction– Layered Architecture , Peer-to- Peer Processes- Interfaces between Layer, Protocols, Organization of the Layers, Encapsulation. 5.2 Layers of the OSI Reference Model open Systems Interconnection model 5.3 Functions of each Layer & Protocols used – Physical Layer, Data-Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer.	10

6. TCP/IP Suite	1. Define addressing mechanism in internet. 2. Describe Layered structure of TCP/IP model. 3. Compare OSI and TCP/IP network model 4. Describe IPv4 & IPv6 5. Design TCP/IP network Model 6. Select required protocol for data transfer in network for various application	6.1 Introduction –Addressing mechanism in the Internet IP-internet protocol Addressing IP Address classes, classless IP addressing, Sub netting, super netting, Masking Layered Structure of the TCP / IP model Host-to Network, Internet, Transport, 6.2 Application TCP / IP Protocol Suite : Host-to-Network–SLIP-Serial line internet protocol and PPP- point to point protocol, Internet Layer-address resolution protocol - ARP,RARP 6.3 IP: Introduction-Internet Protocol version 4-IPv4, IPv6 , Difference between IPv4 & IPv6.Transport Layer- TCP and UDP 6.4 Application Layer- FTP- file transfer protocol , SMTP-simple mail transfer protocol , DNS- domain name system 6.5 Comparison between OSI and TCP /IP Network Model.	08
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Sr.No.	Title of Practical/Lab. Work/Assignments	Units	Hrs.
1.	Identify different Components of Network in your Computer Network Lab.	Basic network concepts, Concept of data communication	02
2.	Identify various types of cable and Connectors	Transmission media	02
3.	Connect computer terminal in various physical topologies and test data transfer	Network topologies & networking devices	04
4.	Connect two hubs/switch by creating crossover connection		04
5.	Install, configure, Share Printer and Folder in Network.		02
6.	Install/configure/Test Networking devices		04
7.	Install server software and device driver software.		02
8.	Configure Peer-to-Peer Network.	OSI reference model	02
9.	Install TCP/IP Protocols and configure advanced features of TCP/IP Protocols.	TCP/IP Suite	04
10.	Mini Project: Prepare detailed report of existing LAN in the Department/Institute		04
Skill Assessment			02
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Concept of Data Communication	00(00)	08(02)	00(00)	08(04)
02	Basic Network Concepts	02(00)	08(04)	06(06)	16(10)
03	Network topologies and Networking devices	02(02)	04(00)	06(04)	12(06)
04	Transmission media	02(00)	08(04)	06(06)	16(10)
05	OSI reference model	02(04)	08(04)	00(00)	10(06)
06	TCP/IP suite	02(00)	00(04)	06(00)	08(04)
	Total	10(06)	36(18)	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	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	3	R	2	5/7
	1	U	2																
02	2	U	4	2	U	4	3	U	4	1	U	4	5	R	4				3/5
03	1	U	4	2	U	4	4	U	4	3	A	4	4	U	4				3/5
04	4	U	4	5	U	4	5	A	4	5	U	4	6	U	4				3/5
05	2	A	6	3	A	6	2	A	6										2/3
06	4	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	Connection of computer in LAN , installation of printer, software etc.	20
2	Configure and installation of test networking device	20
3	Viva voice	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	2	2	2	2	3	2	-	3	2	2
5	-	3	2	2	2	2	3	2	-	3	2	2
6	-	3	2	2	2	2	3	2	3	3	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.	Data Communications and Networking	Behrouz A. Forouzan, Tata McGraw Hill, Forth Edition, 2009	0072967757, 9780072967753
2.	Data communication and computer network	Michael Duck, Pearson Education 2009	9788131726082
3.	Data Communication & Networking	Achyut S. Godbole, Tata McGraw-Hill, Edition, 2011	1259084671, 9781259084676
4.	Computer Networking	Tularam M Bansod, Dreamtech Press, 2013	9789351192084

❖ **E-REFERENCES:**

1. https://www.tutorialspoint.com/data_communication_computer_network/computer_network_types.htm assessed on 12 oct2016
2. <http://searchnetworking.techtarget.com/answer/TCP-and-the-OSI-model> assessed on 12 oct2016

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

1. Network Lab with all PC connected in LAN
2. Network cable connectors(Cat 5/Cat 6/C2G, RJ45,RJ11)
3. Network Lab via Cable or WIFI
4. Layer 2 Switch ,Hub(16 I/O)
5. 24 port Switches, Wi-fi Modems, Router, Firewall

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

S.N.	Name	Designation	Institute / Industry
1.	Mrs. P. H. Gedam	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Mrs. K. G. Giri	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Mr. S. D. Ambade	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mr. M. A. Rahman	Lecturer in Computer Engineering	Government Polytechnic, Nagpur.
5.	Mr. V. M. Sakode	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
6.	Mrs. G. Chavan	Lecturer in Computer Engineering	Government Polytechnic, Nagpur.
7.	Mr. SandipV Darwhekar	Director	Beta Computronics Pvt. Ltd , Nagpur
8.	Mrs Gazzala Ali	Head Electronics	Anjuman Polytechnic , Nagpur
9.	Mr. S. M. Kale	Lecturer Electronics	Government Polytechnic, Gadchiroli.

(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/civl103/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 Jan 2016

❖ **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, inductor, 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 irtc.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.

(An Autonomous Institute of Govt. of Maharashtra)

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	Government 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: 100-140PSI. 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)

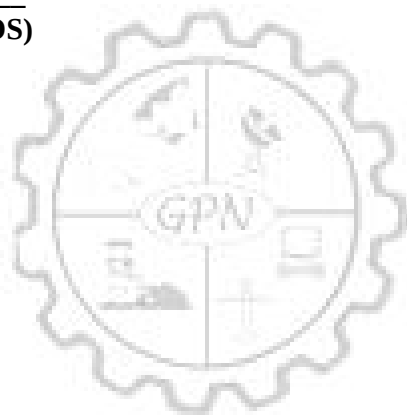
❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

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**

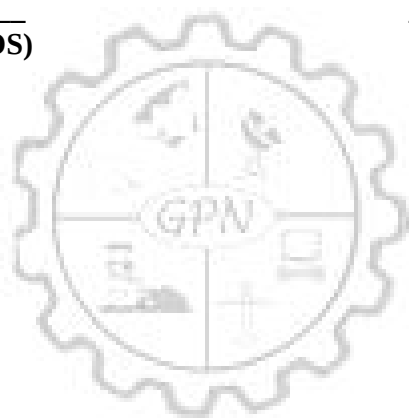
- ❖ As per requirement of related field.

❖ **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 Electronics & Telecommunication Engineering Program

To thrive for academic excellence through creation of innovative, ethical, emotionally intelligent and globally acceptable professionals in the field of Electronics and Telecommunication Engineering satisfying societal and industrial technological needs.

Mission of the Electronics & Telecommunication Engineering Program

- M1 :** To impart high quality electronics and telecommunication engineering education embedded with professional ethics to students.
- M2 :** To adopt the best effective instructional methods in order to maximize knowledge transfer.
- M3 :** To acquire adequate and innovative processes/system to enhance understanding of implementation of theoretical concepts in practical scenarios.
- M4 :** To facilitate the best infrastructure, progressive academic environment to the students and faculty members, creating an ambience, conducive for excellence in electronics and telecommunication engineering education.

Program Educational Objectives - PEOs

- PEO1** : To acquire a fundamental knowledge in engineering and science to improve lives and livelihoods through a successful career in Electronics and Telecommunication Engineering field.
- PEO2** : To develop technical competency to provide solution to the problems in various domain in the field of Electronics and Telecommunication Engineering.
- PEO3** : To attain the skills of professional leadership to deliver effectively in a multi-disciplinary team.
- PEO4** : To attain professional excellence to produce technocrats who ensure professional ethical and moral behaviour to address social, technical and business challenges.
- PEO5** : To engage in lifelong learning and professional development through self study continuing education or professional studies in Electronics and Telecommunication Engineering.

Program Specific Outcomes - PSOs

- PSO1** : Maintain and operate electronics test and measuring equipments.
- PSO2** : Operate and troubleshoot faults in electronic systems.

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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