

OUTCOME BASED CURRICULUM 2016

Program

Diploma in Packaging Technology



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
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- 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 Packaging Technology



by

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Accepted by

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Government Polytechnic, Nagpur

(An Autonomous Institute of Government of Maharashtra)

OUTCOME BASED CURRICULUM-2016

DIPLOMA IN PACKAGING TECHNOLOGY

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CHAPTER 1

Government Polytechnic, Nagpur an Introduction

This chapter gives the history of Government Polytechnic, Nagpur.

1.1 History

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

1.2 Autonomy

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

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

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

1.3 Awards

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

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

1.4 Geographical Location of Nagpur City

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



Figure 1.1. Location of Nagpur City

1.5 Government Polytechnic, Nagpur Campus

Government Polytechnic, Nagpur is situated in heart of the Nagpur City at “Sadar” area, 2.1 km walking distance from zero mile stone as well as Nagpur railway station. The campus map of GPN is shown in Fig. 1.2.



Figure 1.2. Government Polytechnic, Nagpur Campus

CHAPTER 2

Polytechnic Education System

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

2.1 Higher Education System in India

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

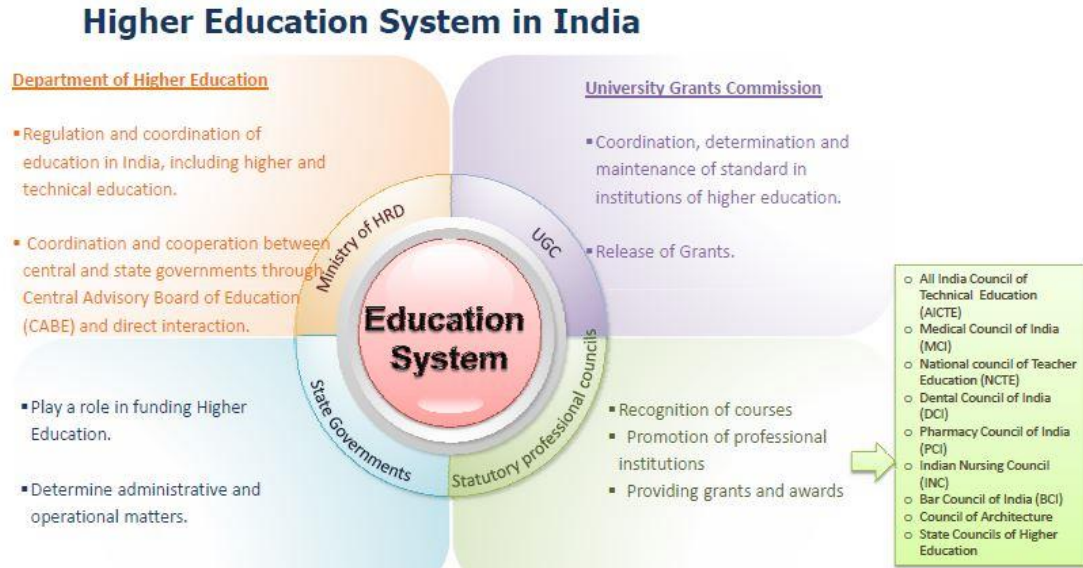


Figure 2.1. Higher Education System in India

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

1. Ministry of Human Resource Development (HRD)

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

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

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

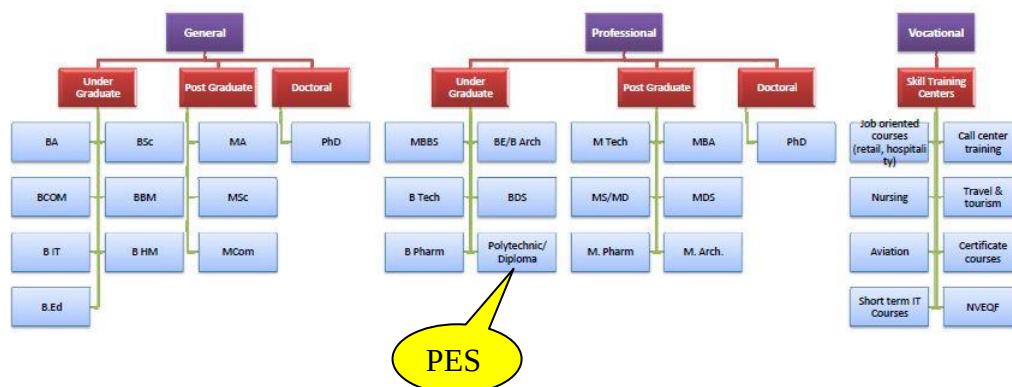


Figure 2.2. Classification of Higher Education System in India

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

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

2.1.1 Department of Higher Education, MHRD

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

2.1.2 All India Council for Technical Education (AICTE)

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

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

2.1.3 National Board of Accreditation (NBA)

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

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

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

2.1.4 Higher and Technical Education, Government of Maharashtra

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

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

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

2.1.6 Maharashtra State Board of Technical Education (MSBTE)

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

2.2 Polytechnic Education System

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

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

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

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

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

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

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

CHAPTER 3

Curriculum Development System

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

3.1 Organizational Structure of GPN

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

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

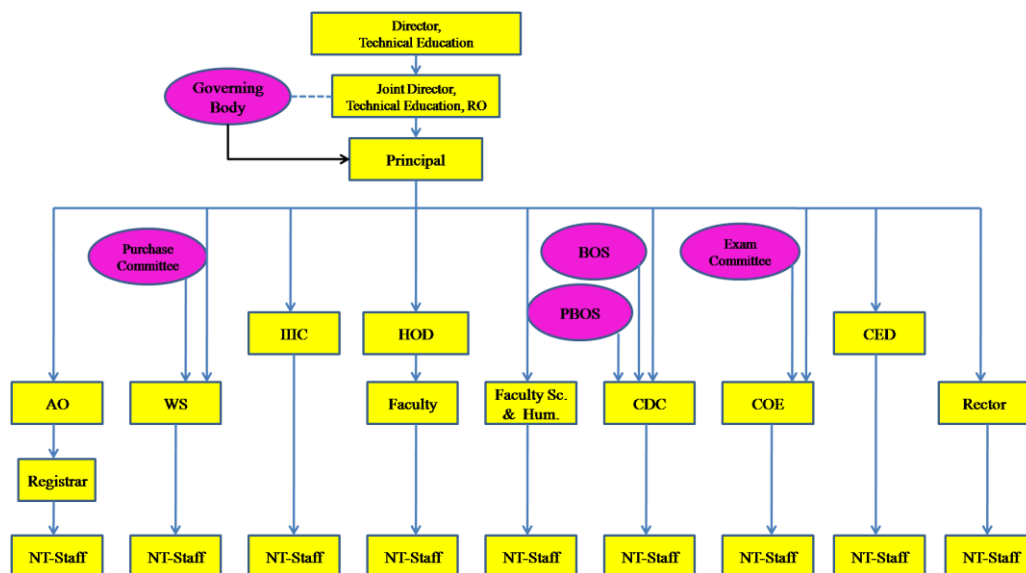


Figure 3.1. Organizational Structure of GPN

3.2 Curriculum Development System

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

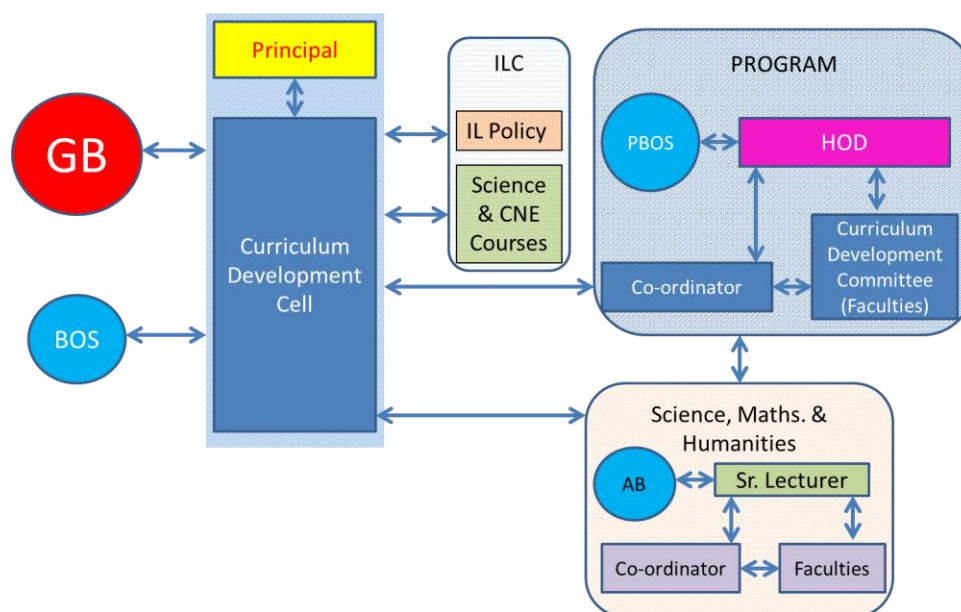


Figure 3.2. Curriculum Development System

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

3.2.1 Governing Board (GB)

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

- **Committee Members:**

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

- **Functions and Responsibilities:**

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

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

3.2.2 Board of Studies (BOS)

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

- **Committee Members:**

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

- **Functions and Responsibilities:**

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

3.2.3 Program Wise Board of Studies (PBOS)

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

- **Committee Members:**

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

- **Functions and Responsibilities:**

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

3.2.4 Advisory Board (AB)

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

CHAPTER 4

Outcome Based Education Philosophy

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

4.1 Outcome Based Education

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

Some Benefits of OBE are-

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

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

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

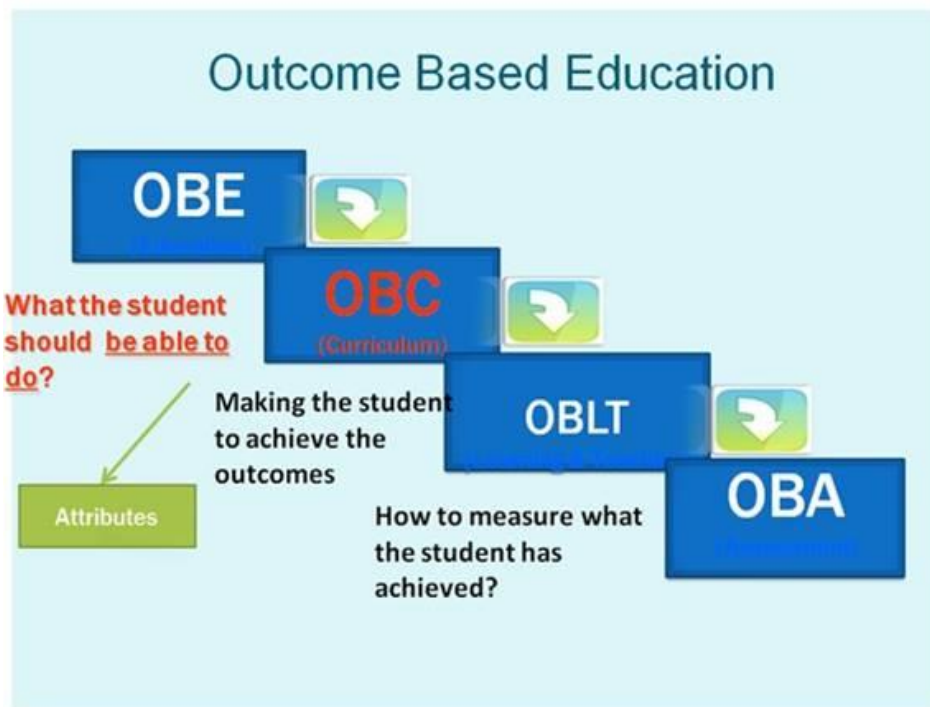


Figure 4.1. Outcome Based Education Framework

4.2 KEY constituents of OBE

Figure 4.2 shows the key constituent of OBE.

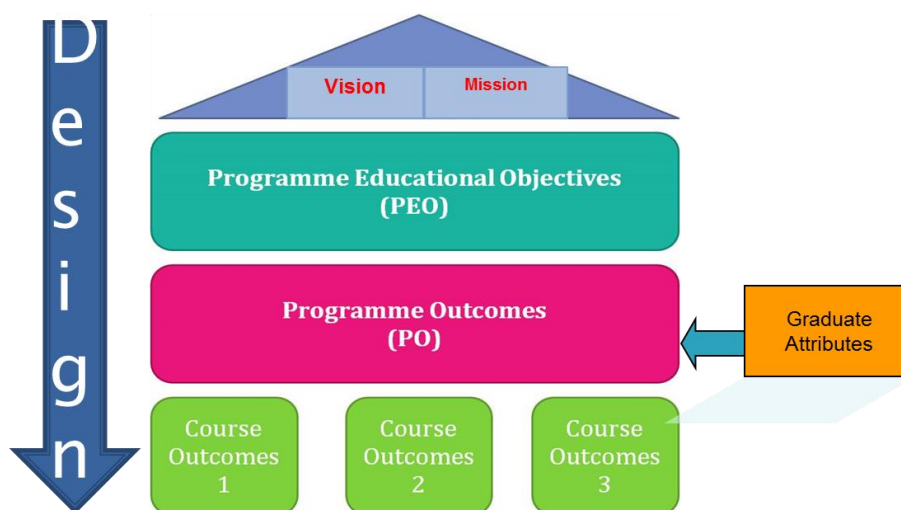


Figure 4.2. Key Constituents of OBE

4.2.1 Vision

Vision is a picture of the future you seek to create, described in the present tense, as if it were happening now. It shows where we want to go, and what we will be like when we get there.

4.2.2 Mission

Mission statement defines what an institution is, why the institution exists, and its reason for being. It defines what we are here to do together.

4.2.3 Graduate Attributes (GA's)

Graduate attributes are the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. WA (Washington Accord) defines 12 GA's for Engineering Graduates.

4.2.4 Program Outcomes (PO's)

Programme Outcomes (POs) describe what students should know and be able to do at the end of the programme. They are to be in line with the graduate attributes (GAs) of NBA. PO's are to be specific, measurable and achievable. POs transform the PEOs into specific student performance and behaviors that demonstrate student learning and skill development.

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

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

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

4.2.5 Program Educational Objectives (PEO's)

The Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to accomplish. PEOs should be measurable, appropriate, realistic, time bound and achievable.

4.2.6 Program Specific Outcomes (PSO's)

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

4.2.7 Course Outcomes (CO's)

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

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

Table 4.1. Difference between Course Outcomes and Course Objectives.

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

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

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

CHAPTER 5

Bloom's Taxonomy

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

5.1 Introduction to Bloom's Taxonomy

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

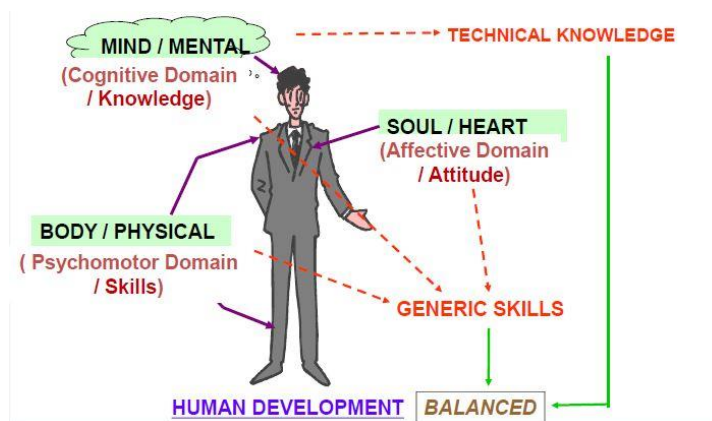


Figure 5.1. Human Being and Domains of Learning

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

5.2 Domains of Learning

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

There are following domains of learning:

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

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

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

5.2.1 Cognitive Domain

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

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

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

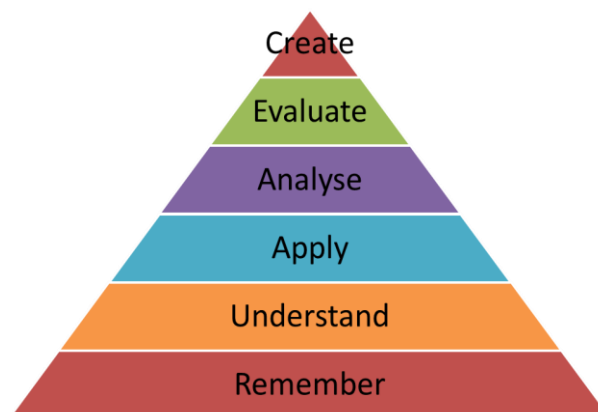


Figure 5.2. Revised cognitive hierarchy Levels

Table 5.1. Cognitive Domain Levels Action Verbs

Cognitive Domain Levels	Behavior descriptions	Action Verbs
Remember	Recall or recognize information	Define, Duplicate, List, Name, Identify, Recall, Reproduce, Recognize, Retrieve
Understand	Understand meaning, re-state data in one's own words, interpret, extrapolate, translate	Calculate, Categorize, Clarify, Classify, Compare, Conclude, Contrast, Describe, Exemplify, Expand, Illustrate, Infer, Interpret, Locate, Paraphrase, Predict, Report, Restate, Summarize, Translate
Apply	Use or apply knowledge, put theory into practice, use knowledge in response to real circumstances	Carry out, Classify, Demonstrate, Execute, Illustrate, Implement, Practice, Solve, Use, Utilize

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

5.2.2 Psychomotor Domain

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

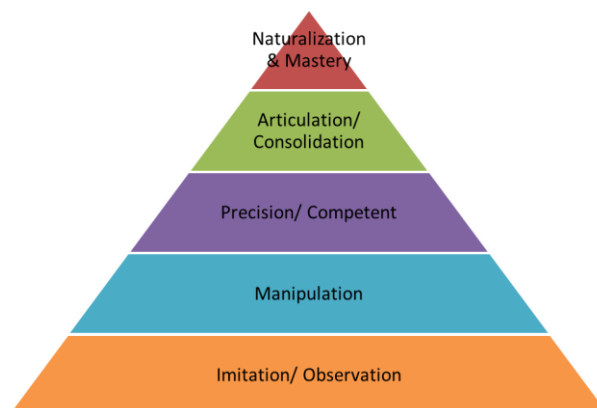


Figure 5.3. Psychomotor hierarchy Levels

Table 5.2. Psychomotor Domain Levels Action Verbs

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

5.2.3 Affective Domain

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

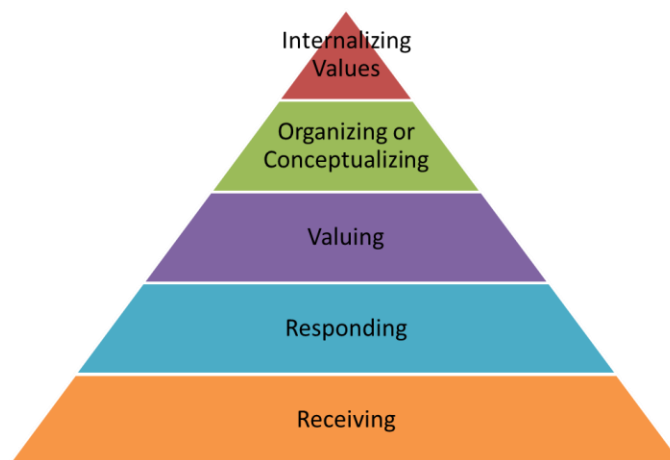


Figure 5.4. Affective Domain hierarchy Levels

Table 5.3. Affective Domain Levels Action Verbs

Affective Domain Levels	Behavior descriptions	Action Verbs
Receiving	Open to experience, willing to hear	Ask, listen, focus, attend, take part, acknowledge, hear, be open to, retain, follow, concentrate, read, do, feel
Responding	React and participate actively	React, respond, interpret, clarify, contribute, question, present, cite, write, perform
Valuing	Attach values and express personal opinions	Argue, challenge, debate, refute, confront, justify, persuade, criticize,
Organizing or Conceptualizing	Reconcile internal conflicts; develop value system	Build, develop, formulate, defend, modify, relate, prioritize, reconcile, contrast, arrange, compare
Internalizing Values	Adopt belief system and philosophy	Act, display, influence, solve, practice,

5.3 Program Outcomes and Domains of Learning

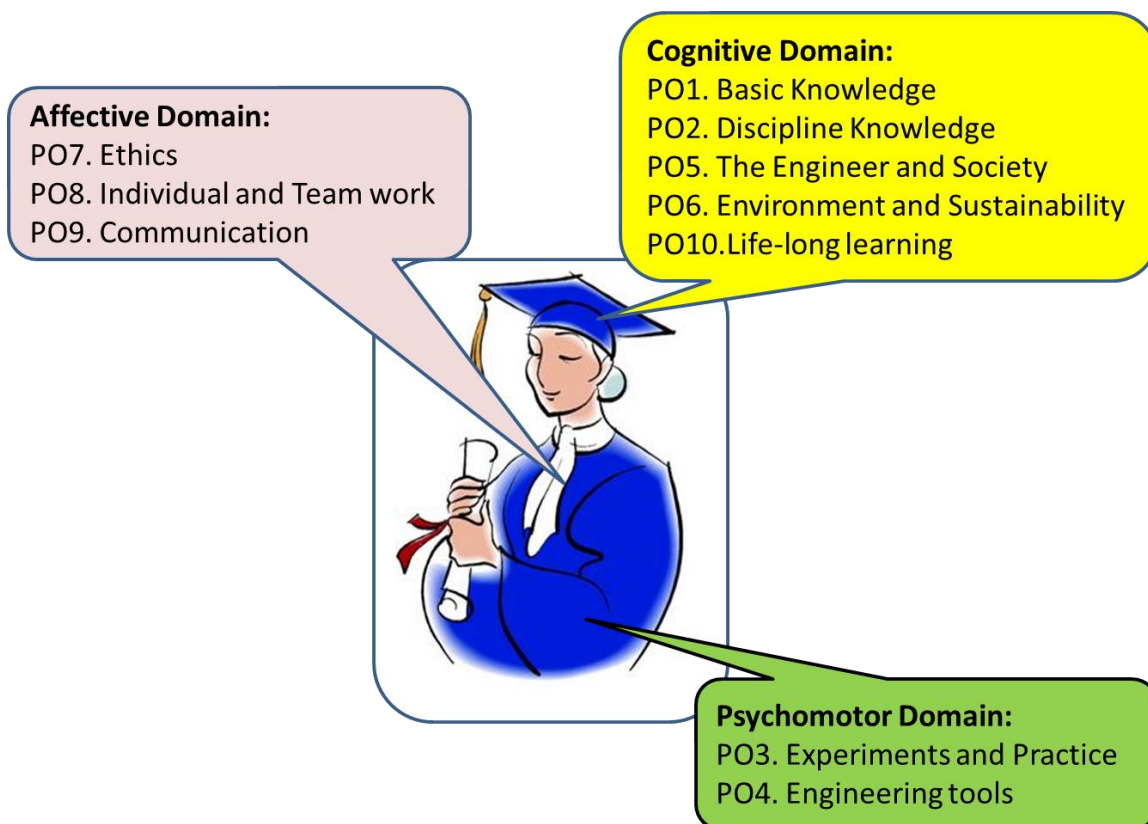


Figure 5.5. Program Outcomes and Domains of Learning

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

CHAPTER 6

Curriculum Revision Process

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

6.1 Change Management

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

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

The ADKAR model is used to:

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

6.1.1 ADKAR Model for Change Management

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

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

Following change management tools are used in curriculum revision process.

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

Figure 6.1 shows the mapping of these tools with ADKAR.

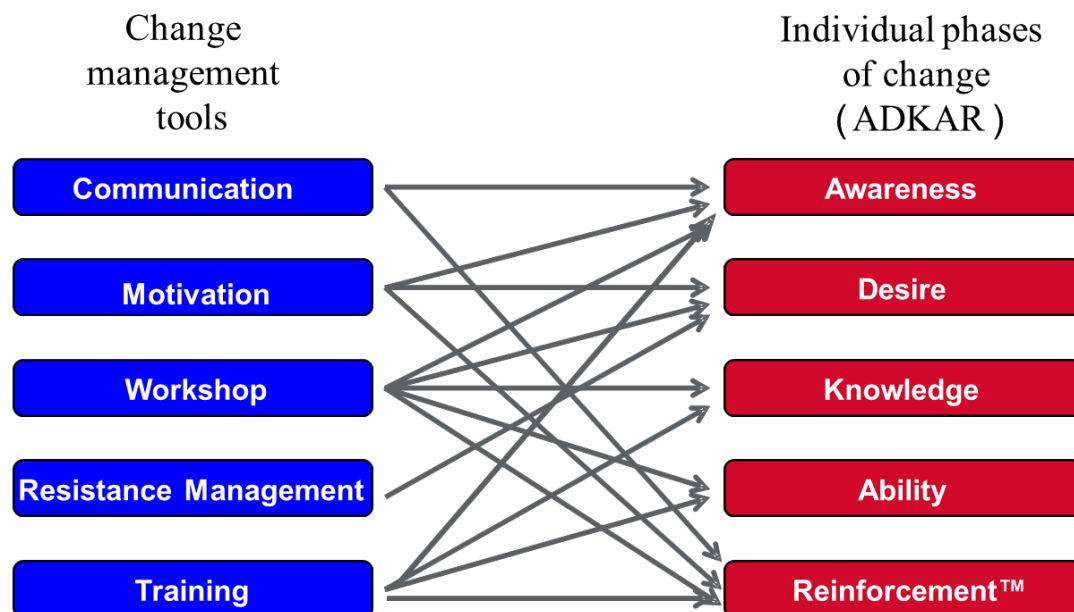


Figure 6.1. Mapping of change management tools with ADKAR

6.1.2 Results of ADKAR Model

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

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

6.2 Curriculum Revision Process

Following Method is adopted for Development of Curriculum

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

6.2.1 Study of OBE Philosophy

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

6.2.2 Analysis of OBE curricula

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

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

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

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

The results are shown in table 6.1 to 6.5

Table 6.1. Credits Comparison

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

Table 6.2. Credit Ratio TH:PR Comparison

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

Table 6.3. Courses Comparison

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

Table 6.4. Examination Scheme Comparison

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

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

*Progressive Test

** Assignments

Table 6.5. Comparison of Autonomous Curricula

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

6.2.3 Comparison with MSBTE Existing Curriculum

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

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

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

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

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

Table 6.8. List of New Courses proposed

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

Table 6.9. Comparison of Examination Scheme with MSBTE Curriculum

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

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

6.2.4 Study of NBA/AICTE/MSBTE Guidelines

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

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

Table 6.10. Abstract of Guidelines

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

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

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

The important guidelines given by MSBE are as follows:

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

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

6.2.5 Search Conference

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

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

6.2.6 Curriculum mapping

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

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

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

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

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

Table 6.11. Curriculum mapping (Sample)

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

6.2.7 Institute Level Policies

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

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

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

1. Levels of Courses V

- **Level I- General studies courses- 5 (5 to 10%)**

1. English
2. Communication Skill
3. Environmental science
4. Economics & Management
5. Rural development (Non Theory)

- **Level II- Basic Science Courses- 6 (15 to 25%)**

6. C programming (including introduction to office tools) (Non Theory) (Note: Letter on this course is changed to Computer Applications as suggested in CM/IT PBOS)
7. Physics
8. Chemistry
9. Mathematics-I
10. Mathematics-II
11. Mathematics- III

(Note: The program which does not require mathematics-III course, may opt for more Computer literacy with numerical analysis courses. Letter on three mathematics courses are converted into two mathematics courses, by increasing the credits)

- **Level III Engineering Sciences and Technical arts courses- 7 (15 to 25%) (should be programme specific)**

12. Engineering Graphics (Theory)
13. Workshop Practice (program specific) (Non Theory)
14. Electrical Science I (Basic Electrical Engineering)
15. Electrical Science II (Electronics and Instrumentation)
16. Material Science and Engineering (program specific)

17. Engineering Mechanics

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

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

19. to 27- Theory cum Practical Courses

28 to 29 – Practical courses (Non-Theory)

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

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

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

32. Industrial Project

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

33. Seminar

34. Industrial Training/Practices

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

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

35. to 42- Theory cum Practical Courses

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

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

43. Finishing School (Common for all Brach)

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.

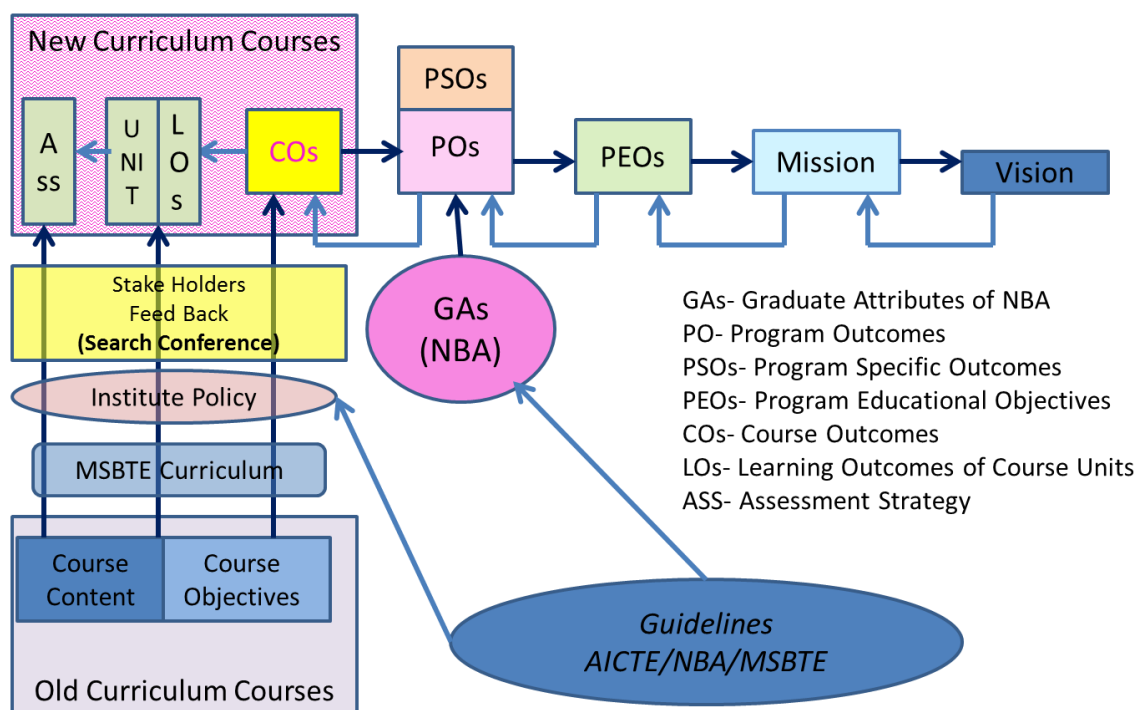


Figure 6.2. GoPoNa Model

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.

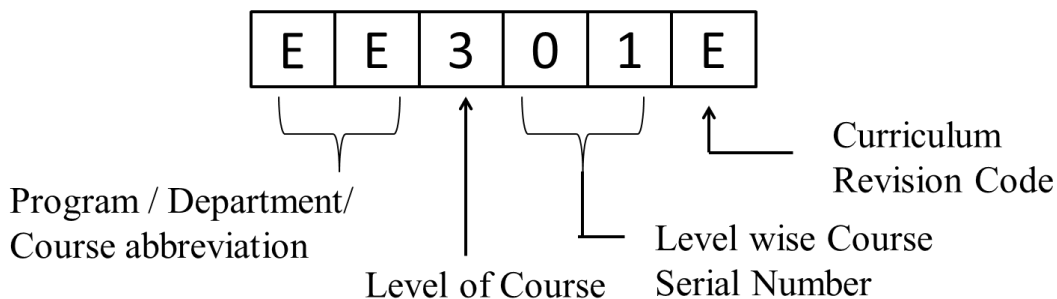


Figure 7.1. Course Code

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 **Packaging Technology** 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 Packaging Technology Program:

To Promote Professional Standards and Competency through Education and Training to Create a World Class Packaging Diploma Engineer.

8.4 Mission of Program

Mission of the Packaging Technology Program:

- M1: To develop competent packaging professionals for the industry and society by providing world class teaching learning facilities.
- M2: To provide Educo-healthy environment that help developing lifelong learning attitude within the student and the staff.

M3: To produce environmentally conscious entrepreneurs by imparting quality education.

M4: To develop soft skills and inculcate ethics to make a versatile personality.

8.5 Program Educational Objectives (PEOs)

The Program Educational Objectives of (PEOs) Packaging Technology Program are:

PEO 1: To create the technical manpower for Packaging and allied industries enriched with basic technical knowledge and skills of packaging materials & methods, package conversion, testing, designing and decoration.

PEO 2: To serve the society and the nation by developing technocrats with reasonable understanding and inclination to environmental aspects & sustainability.

PEO 3: Develop the attitude for life-long learning and professional advancement through self-study and continuing education or professional studies in Packaging Technology.

PEO 4: To produce entrepreneurs who will be able to start his own enterprise on at least small scale basis this will enable him not only to earn his livelihood but also to provide job opportunities to others; hence contributing towards nation building.

PEO 5: To communicate effectively, encourage colleagues and subordinates, maintain values, positive attitude, interpersonal relations and deal effectively with people to achieve personal and organizational goals.

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: Supervise packaging processes.

PSO2: Test and evaluate package and its applied parts.

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

8.8.1 Mapping of Vision and Mission

Table 8.1. Mapping of Vision-Mission

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

8.8.2 Mapping of Mission and PEOs

Table 8.2. Mapping Mission-PEOs

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

8.8.3 Mapping of PEOs and POs- PSOs

Table 8.3. Mapping PEOs-POs & PSOs

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

8.9 Identified Skills in Search Conference

8.9.1 Technical skills for Packaging Technology Diploma Students

- T.1 Prepare engineering drawings using codes, norms and standards manually as well as through CAD software.
- T.2 Prepare simple jobs correctly according to given specification using various tools, measuring instruments and machines for different operations in fitting, smithy, carpentry, pipefitting and metal joining shop.
- T.3 Use various measuring (linear, area, volume, angular, gear, thread, roughness, straightness, squareness, flatness, roundness, pressure, temperature, flow, etc) and gauging instruments-Analog and digital based.
- T.4 Use destructive and nondestructive testing methods.
- T.5 Use foundry materials and simple equipments to cast ferrous and non ferrous materials using material technology and strength of material.

- T.6 Use arc, gas and spot welding and cutting processes to prepare simple jobs.
- T.7 Use hot and cold working equipments for rolling and forging processes to produce parts using material technology and strength of material.
- T.8 Use conventional machine tools. (Lathe, Milling, Shaper, Drilling, Slotting, Planning, etc.)
- T.9 Use surface coating and protection methods.
- T.10 Suggest packaging processes,
- T.11 Appreciate the mechanisms and controls incorporated to carry out the processes.
- T.12 Appreciate basic packaging material conversion processes.
- T.13 Appreciate modern methods of packaging.
- T.14 Use basic structure of plastics, plastic compounds.
- T.15 Identify various thermo plastics & thermosetting plastics.
- T.16 Identify the plastic film structure and its suitability.
- T.17 Analyze properties of packaging materials.
- T.18 Apply packaging consideration for various pharmaceutical and personal hygiene products.
- T.19 Appreciate the packaging consideration for various industrial goods and hazardous goods.
- T.20 Appreciate the laws, regulation & standard in packaging technology.
- T.21 Identify the hazards of distribution for various products.
- T.22 Use packaging considerations for various paints, cements, fertilizers, textiles & handicrafts.
- T.23 Identify suitable packaging materials.
- T.24 Appreciate the provisions of laws and regulations for packaging.
- T.25 Appreciate the basis of classification of foods and food spoilage and deterioration.
- T.26 Appreciate the critical characteristics and special requirements of packages for various types of foods.
- T.27 Appreciate the cold storage preservation techniques
- T.28 Use principles of various printing processes.
- T.29 Use principles of working of machines involved in packaging processes.
- T.30 Develop concepts of aesthetics of package.
- T.31 Compare various printing processes for graphics packaging
- T.32 Comment on the optimum cushioning for various products and packages.
- T.33 Interpret and analyze the various forces acting on a product inside a package.
- T.34 Appreciate and understand the need of economy in packaging processes.
- T.35 Appreciate and understand the need of value engineering in packaging processes.
- T.36 Use costing procedure for different packages.
- T.37 Use and operate different packages & packaging Material testing machines.

- T.38 Select suitable packaging material by considering packaging requirements.
- T.39 Design innovative packages.
- T.40 Analyse the effect of micro organisms and environmental factors on food products.
- T.41 Maintain packaging machines.
- T.42 Use quality control tools for process improvement.
- T.43 Appreciate growth of packaging business, related hazards and environmental issues.
- T.44 Select various manufacturing processes for specific applications.
- T.45 Interpret drawing and Prepare jobs according to it.
- T.46 Select suitable mode of transportation.
- T.47 Perform problem analysis.

8.9.2 Generic skills for Packaging Technology Diploma Holder

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

8.10 2011 Curriculum Mapping with Program Outcomes (POs)

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

Table 8.4. 2011 Curriculum Mapping with POs & PSOs

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
	Basic Knowledge	Discipline Knowledge	Experiments and Practice	Engineering tools	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team work	Communication	Life-Long Learning	Supervise Packaging process	Test and Evaluate package and its allied parts.
EN1101	X	-	X	-	-	-	-	X	X	X	-	-
EN1102	X	-	X	-	-	-	-	X	X	X	-	-
IT1101	X	-	X	X	-	-	-	X	X	X	-	-
ME1101	X	-	-	-	X	X	X	-	-	X	-	X
EV1101	X	-	-	-	X	X	X	X	X	X	-	-
PH1201	X	-	X	X	-	-	-	X	-	X	-	-
CH1201	X	-	X	-	-	-	-	X	-	X	-	-
MH1201	X	-	X	-	-	-	-	X	-	X	-	-
MH1202	X	-	X	-	-	-	-	X	-	X	-	-
MH1203	X	-	X	-	-	-	-	X	-	X	-	-
AM1301	X	-	X	X	-	-	-	X	-	X	-	-
WS1301	X	-	X	X	-	-	X	X	X	X	-	-
ME1301	X	X	X	X	-	-	X	X	X	X	X	-
ME1302	-	X	X	X	-	-	X	X	X	X	X	-
CM1308	X	-	X	X	-	-	-	X	-	X	-	-
AM1307	X	-	X	X	-	-	-	X	-	X	-	-
EE1305	X	-	X	X	-	-	X	X	-	X	-	-

EC1313	x	x	x	x	-	x	-	x	-	x	x	x
PK1301	x	x	x	x	-	x	-	x	-	x	x	x
PK1302	x	x	x	x	-	x	-	x	-	x	x	x
PK1303	-	x	x	x	-	-	x	x	x	x	-	-
PK1304	-	x	x	x	-	-	-	x	x	x	-	-
ME1402	-	x	x	x	-	-	x	x	x	x	-	-
ME1403	-	x	x	x	-	-	-	x	-	x	-	-
PK1401	-	x	x	x	-	-	-	x	-	x	x	-
PK1402	-	x	x	x	-	-	-	x	-	x	x	x
PK1403	-	x	x	x	-	-	-	x	-	x	x	x
PK1404	-	x	x	x	-	-	-	x	-	x	x	-
PK1405	-	x	x	x	-	-	x	x	x	x	x	-
PK1406	-	x	x	x	-	-	-	x	-	x	x	-
PK1407	-	x	x	x	-	-	-	x	-	x	x	-
PK1408	-	x	x	x	-	-	-	x	-	x	x	-
PK1409	-	x	x	x	-	-	-	x	-	x	x	x
PK1410	-	x	x	x	-	-	-	x	-	x	x	-
PK1411	-	x	x	x	x	x	x	x	x	x	x	x
ME1410	-	x	x	x	-	-	-	x	x	x	x	-
ME1416	-	x	x	x	x	-	-	x	x	x	x	-
ME1504	-	x	x	-	-	x	-	x	-	x	x	-
ME1406	-	x	x	x	-	-	x	x	-	x	x	-
PK1501	-	x	x	x	-	-	x	x	-	x	x	x

PK1502	–	x	x	x	–	–	x	x	–	x	x	x
PK1503	–	x	x	x	–	–	x	x	–	x	x	x
PK1504	–	x	x	x	–	–	x	x	–	x	x	x
PK1505	–	x	x	x	–	–	–	x	x	x	–	–
PK1506	–	x	x	–	x	x	–	–	x	x	–	–
PK1507	–	x	x	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. Case Study.
2. Maintenance in Packaging.

8.11 Courses Identification

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

Table 8.5. Courses Identification from Identified Skills

T1, T2,T3..... etc indicates Technical skill with serial number mentioned earlier
G1,GT2,G3..... etc indicates Generic skill with serial number mentioned earlier

Identified Skills	Courses
G5 Communicate effectively orally and in writing. Express views precisely, effectively and positively.	1. English
G4 Maintain values, positive attitude and interpersonal relations. G5 Communicate effectively orally and in writing. Express views precisely, effectively and positively. G6 Use soft skills acquired by the student during their course of work.	2.Communication skills
G3 Use techniques to deal effectively with people in the direction of organizational goals. T 20 Appreciate the laws, regulation & standard in packaging technology.	3.Industrial Management
Common Course to fulfil Program Outcomes	4.Environmental Science
Common Course to fulfil Program Outcomes	5. Rural Development
Common Course to fulfil Program Outcomes	6.Computer Applications
Common Course to fulfil Program Outcomes	7. Engineering Physics
Common Course to fulfil Program Outcomes	8. Applied Chemistry
Common Course to fulfil Program Outcomes	9. Engg. Mathematics
Common Course to fulfil Program Outcomes	10. Applied Mathematics
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software.	11. Engg. Graphics
T2- Prepare simple jobs correctly according to given specification using various tools, measuring instruments and machines for different operations in fitting, smithy, carpentry, pipefitting and metal joining shop.	12. Workshop Practice
Common Course to fulfil Program Outcomes	13. Engg. Mechanics
Common Course to fulfil Program Outcomes	14. Elements of El. Tech.

Common Course to fulfil Program Outcomes	15. Fundamentals of Electronics
T1 - Prepare engineering drawings using codes, norms and standards manually as well as through CAD software. T3 - Use various measuring (linear, area, volume, angular, gear, thread, roughness, straightness, squareness, flatness, roundness, pressure, temperature, flow, etc) and gauging instruments-Analog and digital based. T4 - Use destructive and nondestructive testing methods. T12 - Appreciate basic packaging material conversion processes. T23 - Identify suitable packaging materials. T39 - Use and operate different packages & packaging Material machines. T40 - Select suitable packaging material by considering packaging requirements. T44 - Select various manufacturing processes for specific applications	16. Paper and Board in Packaging
T12 - Appreciate basic packaging material conversion processes. T23 - Identify suitable packaging materials. T37 - Use and operate different packages & packaging Material machines. T38 - Select suitable packaging material by considering packaging requirements. T44 - Select various manufacturing processes for specific applications	17. Traditional Packaging Materials
Common Course to fulfil Program Outcomes	18. Strength of Materials
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software.	19. Engg. Drawing
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software.	20. Machine Drawing
T29 - Use principles of working of machines involved in packaging processes. T41 - Maintain packaging machines.	21. Theory of Machines
T43 - Appreciate growth of packaging business, related hazards and environmental issues.	22. Fundamentals of Packaging
T5 - Use foundry materials and simple equipments to cast ferrous and non ferrous materials using material technology and strength of material. T6 - Use arc, gas and spot welding and cutting processes to prepare simple jobs. T7 - Use hot and cold working equipments for rolling and forging processes to produce parts using material	23. Production Processes

technology and strength of material. T8 - Use conventional machine tools. (Lathe, Milling, Shaper, Drilling, Slotting, Planning, etc.) T9 - Use surface coating and protection methods. T44 - Select various manufacturing processes for specific applications. T44 - Select various manufacturing processes for specific applications. T45 - Interpret drawing and Prepare jobs according to it.	
T5 - Use destructive and nondestructive testing methods. T14 - Use basic structure of plastics, plastic compounds. T15 - Identity various thermo plastics & thermosetting plastics. T16 - Identify the plastic film structure and its suitability. T17 - Analyze properties of packaging materials.	24. Plastic Materials in Packaging
T 18 - Apply packaging consideration for various pharmaceutical and personal hygiene products. T23 - Identify suitable packaging materials. T24 - Appreciate the provisions of laws and regulations for packaging.	25. Packaging of Pharmaceuticals
T28 - Use principles of various printing processes. T30 - Develop concepts of aesthetics of package. T31 - Compare various printing processes for graphics packaging	26. Package Printing and Aesthetics
T12 - Appreciate basic packaging material conversion processes. T15 - Identity various thermo plastics & thermosetting plastics. T16 - Identify the plastic film structure and its suitability. T17 - Analyze properties of packaging materials. T29 - Use principles of working of machines involved in packaging processes. T44 - Select various manufacturing processes for specific applications	27. Plastic Package manufacturing
T32 - Comment on the optimum cushioning for various products and packages. T33 - Interpret and analyze the various forces acting on a product inside a package. T39 - Design innovative packages.	28. Package Design Engineering
T21 - Identify the hazards of distribution for various products. T46 - Select suitable mode of transportation.	29. Logistics and Supply Chain Management
T1- Prepare engineering drawings using codes, norms and standards manually as well as through CAD software. T4 - Use destructive and nondestructive testing methods	30. Package Making

T39 - Design innovative packages.	
T34 - Appreciate and understand the need of economy in packaging processes. T35 - Appreciate and understand the need of value engineering processes. T36 - Use costing procedure for different packages.	31. Packaging Economics and Value Engg.
T10 - Suggest packaging processes, T11- Appreciate the mechanisms and controls incorporated to carry out the processes. T12 - Appreciate basic packaging material conversion processes. T13 - Appreciate modern methods of packaging. T29 - Use principles of working of machines involved in packaging processes. T44 - Select various manufacturing processes for specific applications	32. Packaging Processes
T47 - Perform problem analysis.	33. Case Study
T3 - Use various measuring (linear, area, volume, angular, gear, thread, roughness, straightness, squareness, flatness, roundness, pressure, temperature, flow, etc) and gauging instruments-Analog and digital based. T4 - Use destructive and nondestructive testing methods. T10 - Suggest packaging processes T33 - Interpret and analyze the various forces acting on a product inside a package. T39 - Design innovative packages. G1 - Identify the problem and apply innovative, creative and logical approach for problem solving. G2 - Develop the lifelong learning attitude. G6 - Use soft skills acquired by the student during their course of work. G7 - Work under constraints G9 - Develop and present own technical knowledge, self-learning abilities, creativity, and team working abilities	34. Industrial Project
G2 - Develop the lifelong learning attitude. G6 - Use soft skills acquired by the student during their course of work. G8 - Use the skills of giving and receiving Feedback for improving performance G9 - Develop and present own technical knowledge, self-learning abilities, creativity, and team working abilities G10- Manage time for a given work	35. Seminar
Common Course to fulfil Program Outcomes	36. Industrial Practices/ Industrial Training
T25 - Appreciate the basis of classification of foods and food	37. Elective I: Packaging

spoilage and deterioration. T26 - Appreciate the critical characteristics and special requirements of packages for various types of foods. T27 - Appreciate the cold storage preservation techniques	of Food & Beverages
T27 - Appreciate the cold storage preservation techniques	38. Elective I: Refrigeration in Packaging
T22 - Use packaging considerations for various paints, cements, fertilizers, textiles & handicrafts.	39. Elective II: Packaging of Chemicals
T19 - Appreciate the packaging consideration for various industrial goods and hazardous goods. T20 - Appreciate the laws, regulation & standard in packaging technology	40. Elective II: Packaging of Engineering Goods
T42 - Use quality control tools for process improvement.	41. Elective III: Production Management & Q.A.
T41 - Maintain packaging machines.	42. Elective III: Maintenance in packaging
Common Course to fulfil Program Outcomes	43. Finishing School
Common Course to fulfil Program Outcomes	44. Free Electives

8.12

Program Structure

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

8.12.3

Program Structure Level III: Engineering Sciences and Technical Arts Courses

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

Level III: Engineering Sciences and Technical Arts Courses

DIPLOMA IN PACKAGING TECHNOLOGY												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	ME301E	Engineering Graphics	Nil	02	00	04	04	70	30	Nil	25	125
2	WS301E	Workshop Practice	Nil	00	00	04	02	Nil	Nil	Nil	50	050
3	AM301E	Engineering Mechanics	Nil	03	01	02	05	70	30	50 [@]	25	175
4	EE304E	Elements of Electrical Technology	Nil	04	00	02	05	70	30	50 [@]	25	175
5	EC307E	Fundamentals of Electronics	Nil	04	00	02	05	70	30	50 [@]	25	175
6	PK301E	Paper & Board in Packaging ^{\$}	Nil	04	00	02	05	70	30	50 [#]	25	175
7	PK302E	Traditional Packaging Materials ^{\$}	Nil	04	00	02	05	70	30	50 [#]	25	175
Total				21	01	18	31	420	180	250	200	1050

8.12.4

Program Structure Level IV: Professional Courses

Table 8.9. Program Structure Level IV: Professional Courses

DIPLOMA IN PACKAGING TECHNOLOGY												
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	AM407E	Strength of Material	AM301E	03	01	02	05	70	30	50 [@]	25	175
2	ME401E	Engineering Drawing	ME301E	02	00	04	04	70	30	Nil	25	125
3	ME402E	Machine Drawing	ME401E	03	00	04	05	70	30	Nil	25	125
4	ME403E	Theory of Machines	Nil	03	00	02	04	70	30	50 [#]	25	175
5	PK401E	Fundamentals of Packaging ^{\$}	Nil	04	00	02	05	70	30	50 [#]	25	175
6	PK402E	Production Processes	Nil	03	00	02	04	70	30	Nil	50	150
7	PK403E	Plastic Materials in Packaging	CH201E	04	00	02	05	70 ^{**}	30	50 [@]	25	175
8	PK404E	Packaging of Pharmaceuticals ^{\$}	PK401E	04	00	02	05	70	30	50 [#]	25	175
9	PK405E	Package Printing & Aesthetics ^{\$}	PK401E	04	00	02	05	70	30	50 [#]	25	175
10	PK406E	Plastic Package Manufacturing ^{\$}	PK403E	04	00	02	05	70	30	50 [#]	25	175
11	PK407E	Package Design Engineering ^{\$}	AM301E	04	00	02	05	70	30	50 [#]	25	175
12	PK408E	Logistics & Supply Chain Management ^{\$}	PK401E	03	00	02	04	70	30	50 [#]	25	175
13	PK409E	Package Making	PK401E	00	00	04	02	Nil	Nil	50 [@]	25	75
14	PK410E	Packaging Economics & Value Engg.	PK401E	01	00	04	03	Nil	Nil	50 [@]	25	75
Sub Total (a)				42	01	36	61	840	360	550	375	2125

8.12.5

Program Structure Level IV: Professional Courses (Project Courses)

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

DIPLOMA IN PACKAGING TECHNOLOGY												
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	PK411E	Packaging Processes ^{\$}	50 Credits	00	00	04	02	Nil	Nil	50 [#]	50	100
16	PK412E	Case Study	NIL	00	00	04	02	Nil	Nil	50 [@]	50	100
17	PK413E	Industrial Project ^{\$}	100 credits	00	00	04	02	Nil	Nil	100 [#]	50	150
Sub Total (b)				00	00	12	06	Nil	Nil	200	150	350
c) Industrial Interaction courses												
18	SE401E	Seminar	60 credits	00	00	02	01	Nil	Nil	50 [@]	50	100
Any one from following												
19	ID401E	Industrial Training	70 credits	00	00	02	01	Nil	Nil	50 [@]	50	100
	ID402E	Industrial Practices		00	00	02	01	Nil	Nil	50 [@]	50	100
Sub Total (c)				00	00	04	02	Nil	Nil	100	100	200
Total (a) + (b) + (c)				42	01	52	69	840	360	850	625	2675

8.12.6

Program Structure Level V: Elective Courses

Table 8.11. Program Structure Level V: Elective Courses

DIPLOMA IN PACKAGING TECHNOLOGY												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
a) Professional Electives (one from each group)												
Group 1												
1	PK501E	Packaging of Food & Beverages ^s	50 Credits	03	00	02	04	70	30	50 [#]	25	175
1	PK502E	Refrigeration in Packaging ^s	50 Credits	03	00	02	04	70	30	50 [#]	25	175
Group 2												
2	PK503E	Packaging of Chemicals ^s	50 Credits	03	00	02	04	70	30	50 [#]	25	175
2	PK504E	Packaging of Engineering Goods ^s	50 Credits	03	00	02	04	70	30	50 [#]	25	175
Group 3												
3	PK505E	Production Management & Q.A.	50 Credits	04	00	02	05	70	30	50 [@]	25	175
3	PK506E	Maintenance in Packaging	50 Credits	04	00	02	05	70	30	50 [@]	25	175
Sub Total (a)				10	00	06	13	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	Nil	Nil	50	25	75

8.12.7

Program Structure Level V: Elective Courses

Table 8.12. Program Structure Level V: Elective Courses

DIPLOMA IN PACKAGING TECHNOLOGY												
Sr. No	Course Code	Course Title	Prerequisite courses/credits	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
c) Free Electives Technical (Any one) % Not offered for Program ME												
1	FE501E	Basic Building Drawings	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
2	FE502E	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
4	FE504E	Hobby Electronics	Nil	00	00	04	02	Nil	Nil	50 [@]	25	75
	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)				10	00	14	17	210	90	250	125	675

8.12.8 Program Structure Abstract

Table 8.13. Program Structure Abstract

Abstract

DIPLOMA IN PACKAGING TECHNOLOGY												
Sr. No	Level	Course Title Prerequisite courses/credits	No of Courses	Teaching Scheme (TH,TU,PR Hrs./Week)*			Total Credits*	Examination Scheme (Max. Marks)				
				TH	TU	PR		Theory		Practical		Total Marks
								TEE	CA	TEE	CA	
1	I	General Studies	5	11	01	06	15	280	120	150	75	625
2	II	Basic Science Courses	5	16	02	08	22	280	120	150	75	625
3	III	Engineering Sciences and Technical Arts Courses	7	21	01	18	31	420	180	250	200	1050
4	IV	Professional Courses	19	42	01	52	69	840	360	850	625	2675
5	V	Elective Courses	5	10	00	14	17	210	90	250	125	675
Total			41	100	5	98	154	2030	870	1650	1100	5650

Above program structure approved in PBOS meeting held on 25th April, 2016 for implementation from Academic session 2016-17.

8.13 Award of Class Courses

Table 8.14. Award of Class Courses

DIPLOMA IN PACKAGING TECHNOLOGY												
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	PK301E	Paper & Board in Packaging ^{\$}	Nil	04	00	02	05	70	30	50 [#]	25	175
2	PK302E	Traditional Packaging Materials ^{\$}	Nil	04	00	02	05	70	30	50 [#]	25	175
3	PK401E	Fundamentals of Packaging ^{\$}	Nil	04	00	02	05	70	30	50 [#]	25	175
4	PK404E	Packaging of Pharmaceuticals ^{\$}	PK401E	04	00	02	05	70	30	50 [#]	25	175
5	PK405E	Package Printing & Aesthetics ^{\$}	PK401E	04	00	02	05	70	30	50 [#]	25	175
6	PK406E	Plastic Package Manufacturing ^{\$}	PK403E	04	00	02	05	70	30	50 [#]	25	175
7	PK407E	Package Design Engineering ^{\$}	AM301E	04	00	02	05	70	30	50 [#]	25	175
8	PK408E	Logistics & Supply Chain Management ^{\$}	PK401E	03	00	02	04	70	30	50 [#]	25	175
9	PK501E	Packaging of Food & Beverages ^{\$}	50 Credits	03	00	02	04	70	30	50 [#]	25	175
	PK502E	Refrigeration in Packaging ^{\$}	50 Credits									
10	PK503E	Packaging of Chemicals ^{\$}	50 Credits	03	00	02	04	70	30	50 [#]	25	175
	PK504E	Packaging of Engineering Goods ^{\$}	50 Credits									
11	PK411E	Packaging Processes ^{\$}	50 Credits	00	00	04	02	Nil	Nil	50 [#]	50	100
12	PK413E	Industrial Project ^{\$}	100 credits	00	00	04	02	Nil	Nil	100 [#]	50	150
Total				37	00	28	51	700	300	650	350	2000

8.14 Curriculum at a Glance

Table 8.15. Curriculum at a Glance

SN	CRITERION	RESPONSE
1	Total No. of Courses in a Program	55
2	Total courses required	41
3	No. of courses having Theory papers	29
4	No. of courses having non Theory exam.	12
5	No. of General Studies Courses	5
6	No. of Basic Science Courses	5
7	No. of Engineering Science Courses	7
8	No. of Professional Core Courses	14
9	No. of Professional Elective Courses	3/6
10	No. of Professional Free Elective Courses	2/12
11	No. of Project Courses	3
12	No. of Seminar Courses	2/3
13	Total Credits (1 Th Hr = 1Credit & 2 Pr Hr = 1Credit)	154
14	Total Marks	5650
15	Proportion of Hours (Periods), Th : Pr	52:48 (approx.)
16	Proportion of Credits, Th : Pr	68:32 (approx.)
17	Proportion of Marks; Th : Pr	51:49 (approx.)
18	Total courses for Award of Class	12
19	Total theory paper courses for Award of Class	10
20	Total marks for Award of Class	2000

8.15 Course Flow Diagram

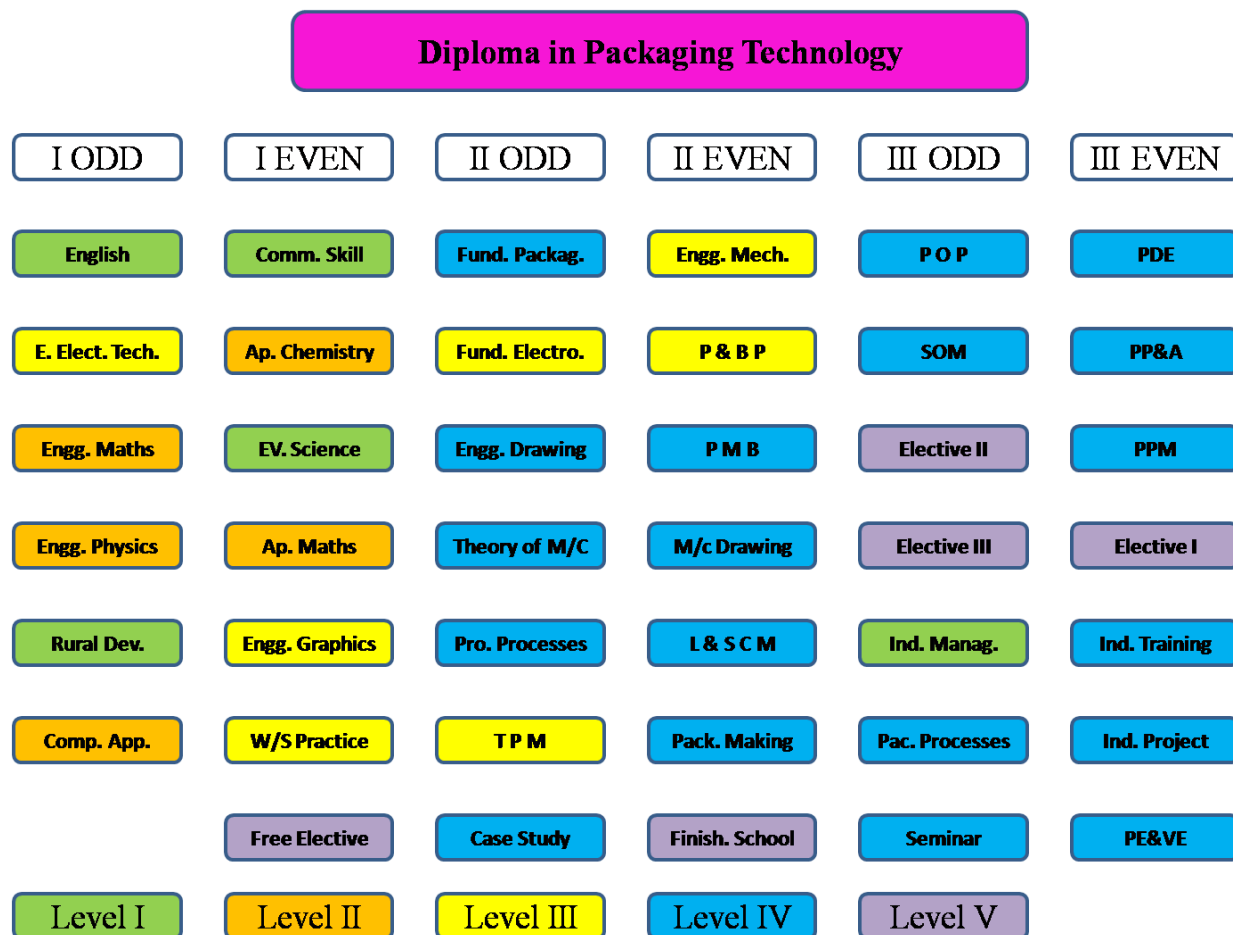


Figure 8.1. Course Flow Diagram

APPENDIX A

Curriculum

LEVEL - I

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Application of Grammar	1. Identify grammatical rules to form correct sentences. 2. Use correct sentence pattern in writing and speaking. 3. Enrich vocabulary. 4. State and identify various tenses to be used in a situation.	1.1 Articles :Appropriate use of definite and indefinite articles 1.2 Prepositions: To use correct prepositions as per context. 1.3 Phrases: Combining words to form various phrases. 1.4 Tenses: Appropriate uses of tenses in given situations. 1.5 Voice: use of active and passive voice. 1.6 Narration: Conversion of direct and indirect speech.	12
2. Text	1. Present oral summary of topics read or heard. 2. Adjust speed of reading. 3. Follow oral instructions and interpret them to others 4. Present summary of topics read and heard.	2.1 Text: Learning to read fluently and to develop insight through prose and poetry. Selected prose and poetry prescribed in the text. 2.2 Prose: 1. Positive Thinking- By Stephen 2. Vision 2020- Dr. A.P.J. Abdul Kalam. 3.What India Wants: A.Our muddled Generation- DineshKumar. B. Employers want Employees not Exam results –Manish Sabharwal. 4. The Last Cab Ride- Kent Newburn 2.3 Poem: 1.Kalahandi-Jaganath Prasad Das 2.Money Madness-D.H. Lawrence 3. Where the mind is without fear- Rabindranath Tagore. 4. Voice of the unwanted Girl-Sujata Bhatt.	16
3. Success stories And Seen passages for Comprehension.	1. Take down lecture notes while listening. 2. Write single or multiple sentences. 3. Comprehend main ideas and reproduce them. 4. Ask pertinent question as well as to answer them.	3.1 Success stories:(selected Two success stories from text) 1."It 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
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

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

❖ **E-REFERENCES:**

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

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

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

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

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

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

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Professional Communication skills	S.R.Pravin, S.Chand Publications	81-219-2092-02
2.	Developing Communication skills	Macmillan Publications, Revised Edition, 2011	0333929195
3.	Business communication and Soft skills.	G.S.R.K , Himalaya Publication, First Edition, 2009	978-81-8488-596-5
4.	Secret of face to face communication.	Peter Urs, Bender, Macmillan Publication	0333937139
5.	Technical communication principles and practices	Meenakshi Raman, Prakash Singh, Oxford University Press,	0-19-567695-5
6	Effective English Communication	Krishna Mohan, Raman Tata McGraw Hills,	13978-0-19-566804-9
7	Modern Commercial Correspondence	R.S.Pillai, Bhagwati, S.Chand & Co.	812190519-2

❖ E-REFERENCES:

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

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

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

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

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

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember U – Understand A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	Nil	

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

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

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

For Other than Mechanical Engineering Program:

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

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

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Industrial Engineering & Management	T.R.Banga & S.C.Sharma, Khanna Publishers, Edition-25, 20142	10: 81-7409-078-9 13:978-81-7409-078-9
2.	Industrial Engineering And Management	O.P. Khanna, Dhanpat Rai, New Delhi, 1980	81-885-9777-5
3.	Industrial organization and management	Lawrence L Bethel & James L Riggs, New York, McGraw-Hill [1971], 6 th , 1979	09-322-3849-1
4.	Industrial Management	I.K.Chopde & A.M.Sheikh, S.Chand & Co. Ltd, Delhi, 2 nd , 1999	81-219-1480-9
5.	Industrial engineering: Organization and management	Tara Chand, Publisher: Nem Chand, 5 th , 1982	B0007BSSB0
6.	Engineering Economics	Tara Chand, Publisher: Nem Chand, 14 th , 2014	81-85240-82-5
7.	Entrepreneurial Development	S.S.Khanka, S.Chand & Co. Ltd, Delhi, 1 st , 1999, reprint 2006	81-219-1801-4

❖ **E-REFERENCES:**

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

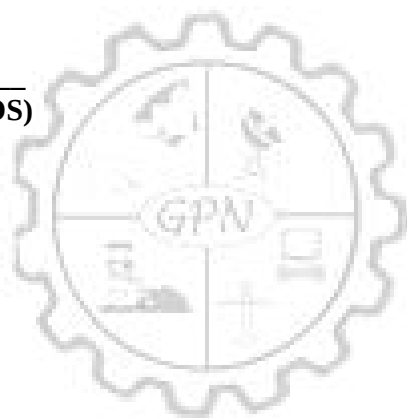
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Nil

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

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

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

Nil

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

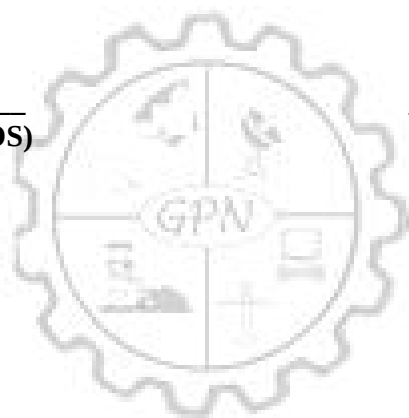
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

Nil

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

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

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

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

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

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

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

- www.un.org/esa/agenda21/natlinfo/countr/israel/ruraldevelopment.pdf , assessed on 5th March 2016
- rural.nic.in/sites/downloads/NewReleases/Greening_RD_Report.pdf , assessed on 5th March 2016
- planningcommission.nic.in/plans/stateplan/sdr_punjab/sdrpun_ch5.pdf, assessed on 5th March 2016
- jica-ri.jica.go.jp/IFIC_and_JBICI-Studies/english/.../pdf/chapter4.pdf. assessed on 5th March 2016
- www.fao.org/3/a-ah885e.pdf, assessed on 5th March 2016
- [yojana.gov.in/CMS/\(S\(y4dqr55g1m1qhnd4soqih45\)\)/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 ME/AE/MT/PK
LEVEL NAME	: BASIC SCIENCE COURSES
COURSE CODE	: CH 201E
COURSE TITLE	: APPLIED CHEMISTRY
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: 02 HRs (Internal)
PT.	: 01 HR

❖ RATIONALE:

Chemistry is the basic science which is essential to all engineering courses. For an engineer, the usage of equipments and instruments would require knowledge of chemical substances, their composition and properties. Chemistry subject knowledge also aims to bridge the theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in the field of engineering.

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ COURSE DETAILS:

A. THEORY :

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

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

assessed on 2 Feb. 2016

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

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

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

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

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

1. Electronic balance (measure up to 0.001 mg)
2. Battery 12 volt
3. Digital multi-meter
4. Rheostat assorted sizes
5. Voltmeter mi 0-150-300 V
6. Ammeter MI 0-5-10 A
7. Electrolytic cell set up
8. Muffle furnace(temp. measure up to 1500⁰ c)
9. Oven (temp measure up to 500⁰ c)

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

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

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ **RATIONALE:**

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

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

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

❖ COURSE DETAILS:

A. THEORY :

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	NIL	

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

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

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

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

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

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ COURSE DETAILS:

A. THEORY:

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

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

B LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
NIL		

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

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

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

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

(Member Secretary PBOS)



(Chairman PBOS)

LEVEL - III

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

Engineering graphics is the language of engineers. It describes the fundamentals, facts, concepts, principles and techniques of Engineering Graphics. The course illustrates techniques of drawing in an engineering field. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. It helps to develop the idea of visualizing the actual object or part on the basis of drawings and blue prints. This course is useful in developing drafting and sketching skills of the student. This preliminary course aims at building a foundation for the further course in drawing and other allied courses.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ COURSE DETAILS:

A. THEORY :

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
Nil		

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

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

For Other Programs:

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

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

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards, Third Reprint, October 1998	81-7061-091-2
2.	Engineering Drawing	N.D.Bhatt, Charotar Publishing house 2010	978-93-80358-17-8
3.	Machine Drawing	N.D.Bhatt & V. M Panchal, Charotar Publishing house 2010	978-93-80358-11-6
4	Engineering Drawing	D.A.Jolhe, Tata McGrawHill Edu.2010	978-0-07-064837-1
5.	Engineering Drawing	R. K. Dhawan , S. Chand&co.	81-219-1431-0
6	Engineering Drawing	P. J Shaha, S.Chand&co.2008	81-219-2964-4

❖ **E-REFERENCES:**

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

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

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

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

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

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ COURSE DETAILS:

A. THEORY :

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

Note: Jobs should be Programme specific.

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Nil

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

Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF JOB EVALUATION:**

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

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

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

For Other Programs:

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

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

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

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

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

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN PACKAGING TECHNOLOGY
LEVEL NAME	: ENGINEERING SCIENCE AND TECHNICAL ART COURSES
COURSE CODE	: EC307E
COURSE TITLE	: FUNDAMENTALS OF ELECTRONICS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02(CLOCK Hrs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)
TH.TEE	: 03 HRs
PR.TEE	: 02 HRs (Internal)
PT.	: 01HRs

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Analyze the functioning of Electronic components.
2. Use semiconductor devices in Electronic circuits
3. Analyze the function of different transducer and their applications.
4. Use different Equipments / meters for measurement and testing of Electronic circuit.
5. Select different signal conditioning circuits.
6. Identify different parts of Microprocessor & Microcontroller.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Electronic Components	1. Define various terms related to electronics component. 2. Draw symbols of various components. 3. Describe the working principle and list out applications of electronic devices. 4. Describe working principle P-N junction diode. 5. Describe working principle Photodiode 6. Differentiate NPN & PNP transistor.	1.1 Definition of Active and passive components. 1.2 Definition, symbolic representation and application of Resistors, Inductor and Capacitors. 1.3 Definition of Semiconductor, Types of semiconductor – Intrinsic & Extrinsic Semiconductor. 1.4 Formation of Depletion layer. 1.5 Schematic symbols, working principle and applications of • P N junction diode, Zener Diode, Varactor diode • Photo-devices – LDR, Photodiode, Phototransistor, LED. 1.6 Construction & working principle of NPN and PNP transistor.	12
2. Electronic Circuits	1. Sketch the circuit diagram with relevant waveforms for rectifiers. 2. Sketch the circuit diagram of single stage common emitter amplifier. 3. Draw the circuit diagram of half Wave Rectifier. 4. Describe oscillator with the help of block diagram.	2.1 Circuit diagram and input-output waveform of Half Wave Rectifier (No Mathematical derivations) 2.2 Circuit diagram and input-output waveform of Full Wave Rectifier (No Mathematical derivations) (Center tapped rectifier). 2.3 Definition of amplifier. 2.4 Circuit diagram, explanation of single stage common emitter amplifier. 2.5 Definition of oscillator. 2.6 Block diagram of oscillator. 2.7 Positive feedback and Negative feedback. 2.8 Barkhausen criteria.	10
3. Basics Of Digital Technology	1. Draw the symbol for various logic gates. 2. Write the truth table for various logic gates. 3. Classify number system. 4. Design AND & NOR gate using NAND gate.	3.1 Decimal Number System 3.2 Binary Number System 3.3 Conversion of Binary to Decimal and vice versa 3.4 Classification of Logic Gates 3.5 Basic Gates: AND, OR, NOT 3.6 Universal Gates: NAND, NOR 3.7 Exclusive Gates: XOR, XNOR	8

4. Transducer And Sensor	1. Define transducers. 2. Classify different types of transducers. 3. Measure a particular physical quantity by specific transducers. 4. Define sensor and classify types of sensor. 5. Describe construction & working principle of LVDT. 6. Differentiate between LVDT & RVDT.	4.1 Definition of Transducer 4.2 Classification – Active/Passive, Primary/Secondary, Electrical, Mechanical, Optical and their examples 4.3 Construction & working principle of - LVDT, RVDT 4.4 Construction & working principle of - Strain gauge and load cells. 4.5 Definition of sensor. 4.6 Types of sensor. 4.7 Proximity sensor 4.8 Infrared photo sensor 4.9 Level detector sensor 4.10 Pressure Sensors - Bourdon Tube 4.11 Temperature Sensors - Thermocouple, RTD, Thermistors.	12
5. Signal Conditioning And Data Converters	1. State the need of signal conditioning. 2. Draw block diagram of signal conditioning. 3. Describe successive approximation of A to D converter with the help of diagram. 4. Illustrate the process of analog to digital signal and digital to analog signal conversion.	5.1 Need of signal conditioning. 5.2 Block diagram of AC and DC signal conditioning. 5.3 Block diagram, Working and applications of Operational amplifier. 5.4 Block diagram of A to D converter. 5.5 Types of A to D converter – Successive approximation & dual slope A to D converter. 5.6 Block diagram of D to A converter 5.7 Types of D to A converter - R-2R Ladder & weighted resistor D to A converter.	12
6. Microprocessors & Microcontrollers	1. Describe the basic PLC architecture. 2. Define IC. 3. Describe the working of PLC. 4. Compare microprocessor and microcontrollers.	6.1 IC – Definition, classification. 6.2 Block diagram of microprocessors. 6.3 Block diagram of microcontrollers. 6.4 Difference between microprocessor and microcontrollers. 6.5 Classification and application of microcontrollers. 6.6 Block diagram of Programmable logic controller (PLC) 6.7 Commercial specifications of PLC (No Programming).	10
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practic al's	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Set the different controls of function generator for the measurement of amplitude, frequency& time period.	General Electronic Measurement Techniques	2
2	Set the different controls of oscilloscope for the measurement of different waveform parameters.		4
3	Measure the AC, DC voltage and AC, DC current with the help of multimeter. Measure the value of given resistance with the help of multimeter. Test the component with the help of multimeter.(diode, capacitor, transistor)		4
4	Test different components like resistor, capacitor, inductor, diode and transistor and draw symbols& test with multimeter.	Study Of Basic Electronic Components	2
5	Assemble the circuit for half wave, full wave rectifier (Center tapped rectifier). Plot its input and output waveforms.	Electronic Circuits	4
6	Connect different logic gates & relate their truth table.	Basics Of Digital Technology.	4
7	Measure linear displacement using LVDT.	Transducer And Sensor	2
8	Measure temperature using thermistor and thermocouple.		
9	Analyze the output of A to D and D to A Convertor	Signal conditioning and Data Converters	2
10	Identify different parts of Microprocessor.	Microprocessors & Microcontrollers	2 2 2
11	Identify different modules of PLC depending on technical and commercial specifications.		
12	Identify different parts of Microcontroller.		
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	Study of Basic Electronic Components	02(04)	08(04)	06(00)	16(08)
02	Electronic Circuits	02(00)	08(06)	00(00)	10(06)
03	Basics of Digital Technology.	06(02)	10(04)	00(04)	16(10)
04	Transducer And Sensor	02(00)	08(00)	00(06)	10(06)
05	Signal Conditioning And Data Converters	00(02)	04(04)	06(00)	10(06)
06	Microprocessors & Microcontrollers	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	R	4	4	U	4	1	R	4	5	U	4				3/5
04	3	U	4	4	U	4	5	U	4	6	U	4	3	A	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.	10
2	Performance	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)										PSO	
	1	2	3	4	5	6	7	8	9	10	1	2
1	3	-	-	-	-	-	-	-	-	3	-	-
2	3	-	-	-	-	-	-	-	-	3	-	-
3	3	-	-	-	-	-	-	-	-	3	-	-
4	3	-	2	2	-	-	2	2	-	3	-	-
5	3	-	2	2	-	-	2	2	-	3	-	-
6	3	-	2	2	-	-	2	2	-	3	-	-

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

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/117103063>
- <http://www.electronicsforu.com>
- <https://www.youtube.com/watch?v=w8Dq8bITmSA>

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

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. Regulated Power Supply
4. Digital Multi-meter
5. Cathode Ray Oscilloscope (0-50 MHZ)
6. Function Generator

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Textbook of Applied Electronics	R. S. Sedha, Revised Edition, S. Chand Limited, 2008	8121927838, 9788121927833
2.	Modern Digital Electronics	R. P. Jain, Tata McGraw-Hill Education, 2010, Fourth Edition.	0070669112, 9780070669116
3.	Microprocessor Architecture, Programming, and Applications with the 8085	Ramesh S. Gaonkar, 3rd Edition, Prentice Hall, 1996	0131988557, 9780131988552
4.	A Course in Electrical and Electronics Measurement and Instrumentation	A.K. Sawhney, Dhanpat Rai Publication, 10th Edition, 1994	
5.	Introduction to programmable Logic Controllers	Gary Dunning, Rockwell lab M, Delmar, Second Edition	1401884261
6.	Programmable logic Controllers	Bolton, 2006	0750681128

❖ **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. Brahmarkar	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
4.	Mrs.R. R. Vairagade	Lecturer in Electronics Engineering	Government Polytechnic, Nagpur.
5.	Ms.K. G. Giri	Lecturer in Electronics	Government Polytechnic, Nagpur.
6.	Ms.P.F.Dorlikar	Lecturer in Electronics	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

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

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN PACKAGING TECHNOLOGY
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: PK301E^s
COURSE TITLE	: PAPER & BOARD IN PACKAGING
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. EXAM	: 01 HR.

❖ **RATIONALE:**

Paper & paperboard are the fibrous natural materials widely used in almost all levels i.e. primary, secondary and tertiary of packaging. While pursuing education in Packaging Technology it is essential to know Paper and Paperboard as raw material, their characteristics, properties, conversion processes and applications of their various useful forms in Packaging. Hence this course covers Paper and Paperboard as raw material, their properties, manufacturing or conversion processes, applications, etc.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Select appropriate type of Paper and Paperboard for packaging applications.
2. Recommend appropriate conversion procedure.
3. Identify various types of packages.
4. Operate various testing machines.
5. Conduct various types of tests.
6. Determine various performance parameters.

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Paper and Paper Board	1. Recall Indian paper & pulp industry. 2. List materials used for paper making, types of paper & boards, various properties of paper, examples of paper & board products, environmental concerns. 3. Define various terminologies of Paper and Paper Boards. 4. State Regulatory Requirements & environmental issues. 5. Describe properties, characteristics and applications of paper and board. 6. Classify various types of paper & paperboards. 7. Differentiate paper with paperboard on the basis of various points. 8. Identify different types of papers and paper boards.	1.1 Indian paper & pulp industry - overview, raw materials used, their functions, types of fibers. 1.2 Properties of paper and paper boards- Physical/mechanical, surface and optical. 1.3 Nomenclature of paper products, Main packaging papers, Applications of different types of papers in Packaging, Applications of unconverted paper like wrapping, interleaving, stiffening & supporting, shock absorption & space filling, types of wrapping materials available, Papers for conversion, 1.4 Paper Board- Terminology, structure, related definitions. 1.5 Storage of paper & paper board. 1.6 Regulatory Requirements, Water consumption, water pollution, air pollution, solid waste generation, Environmental concerns, Eco mark criteria, Role of Forest stewardship council and recycling of paper & paper products.	12
2. Paper Bags	1. List materials used in bag making 2. Define given types of paper bags. 3. Describe various bag making process 4. Describe various filling and closing techniques. 5. Choose appropriate paper bag for specific application. 6. Sketch/draw various types of paper bags.	2.1 Paper bag making process - raw material used, making by hand and by machines. 2.2 Types of paper bags and envelopes - Flat bags, Square bottom flat bags, Square bottom gusseted type bags, SOS bags, Satchel Bottom bags, Multi walled paper bags, Yarn-net laminated paper bags, Jute laminated paper bags, Bag closing. 2.3 Bitumen laminated paper bags. 2.4 Applications and suitability of paper bags and multi walled paper sacks in packaging of products.	8
3. Paperboard Folding Cartons	1. Define various terminologies involved in Folding Cartons manufacturing.	3.1 Introduction to cartoning, raw materials used, Cartons and its types, constructional features of various types of cartons, carton	18

	- List types of cartons, steps in cartoning or conversion, types of tetra packs, layers in tetra pack wall, Quality issues. - Describe construction features of various types of folding cartons, entire conversion process, cartoning process. - Describe causes and remedies of various quality problems in folding cartons, laser cutting process. - Sketch various styles of folding cartons. - Investigate cause of quality issues. - Identify various folding carton styles. - Compare flat die and circular die processing on the basis of various points.	shapes, specialty cartons and its designing, applications of specialty cartons and their suitability. 3.2 Conversion process – steps, blank design and blank preparation, blank layouting, blank cutting, blanking tools and its design, 3.3 Flat die and circular die-construction and applications, elements of blanking tools, carton blank punching m/c, constructional features and operational features of platen punching m/c, die cut punched carton, carton lining, inserts. 3.4 Open end cartons, open top cartons, Wrap around cartons: features, sketch & applications 3.5 Modern trends: Tetrapack, its types, terapack wall structure, applications, and laser cut cartons - laser cutting process and applications, latest innovations. 3.6 Quality issues: Un-sharp cut, fishtailing and improper gluing - causes and remedies of above quality issues.	
4. Fiberboard Boxes	- Define various terminologies in Fiberboard Boxes. - List raw materials used types of boards and setup equipments of Fiberboard Boxes. - Describe manufacturing of various type of Fiberboard Boxes - Distinguish between various types of fiberboard containers. - Design given layout for CFB box. - Determine material requirement for given CFB box. - Identify type of flutes. - Determine Grammage of CFB and weight of given CFB box.	4.1 Introduction to box making, Difference between cartons and boxes, CFB and SFB boxes, Strength and load parameters. 4.2 Corrugated boxes - Complete set up of Corrugators plant, Raw materials used, types of corrugated boards, types of flutes, flute specifications. 4.3 Corrugated fiber board making process - single face corrugation unit, construction and working principle of this machine. 4.4 Single piece blank and two-piece blank. 4.5 Board to box conversion - Creasing & cutting, printing, slotting and die cutting, stitching gluing or taping, closing & sealing, machines used for these operations - construction and working principles of these	18

	9. Identify various defects in CFB Box. 10. Describe causes of various defects in CFB Boxes 11. Suggest remedies for various defects.	machines. 4.6 Styles of corrugated boxes, Advantages, disadvantages and applications. 4.7 Operations involved in making of different styles of boxes – RSCs and other slotted boxes, die cut boxes, trays and special conversions, tier sheets and slip sheets. 4.8 Box quality and quality control: Compression Strength, Grammage, ECT, FCT, RCT. 4.9 Major quality concerns or defects in box making – fishtailing, delamination, wash board, soft board, issues in joints, un sharp slotting, un sharp die cuts, low gsm, low caliper board etc., causes and remedies of above defects. 4.10 Solid Fiberboard Boxes, honeycomb boards. Hessian laminated board, moulded corrugated pulp, cross fluted board, construction and applications of above. 4.11 Setup boxes: Raw materials used, types of boxes - full telescope, hinged cover, tray style, and neck & shoulder style etc., Construction/ manufacturing and applications of these boxes.	
5. Other Paper Products	1. Define various terms related to other paper products. 2. List applications of paper cups, various types of composites. 3. Describe given manufacturing processes. 4. Describe construction of given product. 5. Sketch structure of given composites.	5.1 Papers Cups, cones, Ice-cream & other cups, paper crimped cups – manufacturing, advantages, limitations and applications. 5.2 Composites - Paper laminates, Aluminum/ paper laminates, Fiber cans, SFB Drums and tubes construction/manufacturing and applications.	8
Total Hrs.			64

B LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Conduct the tests to identify the Grain direction of paper/board.	Paper and Paper Board	2
2	Conduct the tests to determine Top side & wire side of paper / paper -board.		2
3	Conduct the test to determine Brightness of white, near-white, and naturally colored paper/paperboard.		2
4	Perform Grammage/GSM test - on paper/ paperboard/corrugated fiberboard.	Paper Bags	2
5	Carry out Burst strength test & calculate burst factor - for paper & paperboard.		2
6	Perform Tensile strength test - on paper/paper board.		2
7	Perform Tear strength test (Internal) - on paper/paper boards.	Paperboard Folding Cartons	2
8	Conduct the test to find out Breaking length of paper/ paperboard.		2
9	Conduct the test to find out thickness/caliper of paper / paperboard.		2
10	Conduct Folding endurance test - for paper/paperboard.		2
11	Conduct Cobb test to find out water absorptiveness/water penetration ability of paper/ paperboard/corrugated fiberboard.	Fiberboard Boxes	2
12	Conduct Ring crush test to find out ring crush strength of Kraft paper/ paperboard.		2
13	Conduct Edge crush test to find out edge crush strength of corrugated fiber board.		2
14	Perform Puncture test to find out puncture resistance of paperboard/ corrugated fiber board.		2
15	Conduct Flat crush test to find out flat crush strength of corrugated fiber board.		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	
1	Paper and Paperboard	08(02)	04(04)	00(00)	12(06)
2	Paper Bags	04(02)	04(04)	00(00)	08(06)
3	Paperboard Folding Cartons	02(06)	12(00)	06(04)	20(10)
4	Fiberboard Boxes	02(00)	12(08)	06(04)	20(12)
5	Other Paper Products	06(00)	04(06)	00(00)	10(06)
Total		22(10)	36(22)	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	1	R	2	2	R	2	2	R	2	3	R	2	4	R	2	1	R	2	5/7
	2	R	2																
02	1	U	4	2	U	4	3	U	4	1	U	4	2	U	4				3/5
03	3	U	4	3	U	4	4	U	4	4	U	4	4	U	4				3/5
04	4	U	4	4	U	4	5	U	4	3	A	4	4	A	4				3/5
05	1	R	6	5	R	6	3	R	6										2/3
06	3	A	6	4	A	6	5	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Procedure/drawings/Test piece preparation/I.S.Referred, etc.	10
2	Performance/Skill	20
3	Inference/ Result/ Conclusion, etc.	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	-	-	1	1	-	-	-	3	-	3
2	3	3	-	-	-	-	-	-	-	3	-	-
3	3	3	-	-	-	-	-	-	-	3	-	-
4	3	3	2	2	-	-	-	2	2	3	-	3
5	3	3	2	2	-	-	-	2	2	3	-	3
6	3	3	2	2	-	-	-	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.	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, PHILPL, 2E, 2014	978-81-203-5054-0
2.	Handbook on Pulp & Paper Industries	SIRI Board of Consultants & Engineers, SIRI Pub., 1990.	81-85480-24-9
3.	The Wiley Encyclopedia of Packaging Technology	Kit L. Yam,, John Wiley & Sons Inc., 3E, 2010.	9780470541395
4.	The Packaging Designers Book of Patterns	Laszlo Roth, George L/ Wybenga, Wan Nostrand, Reinhold, 1991.	0-442-00524-5
5.	Paper, Paper Converting, Plastics & Other Pkg. Ind.	R. K. Kush, SBP Pub. Co., 1995.	--
6	Handbook of Pulp & Paper Technology	Kenneth W. Britt, CBS Publishers, 2E, 2004.	9788123911441, 8123911440

❖ **E-REFERENCES:**

- <http://www.pulpandpaper-technology.com/articles/id/Paperindustry>, assessed on 1st June 2016.
- <http://www.indianmirror.com/indian-industries/paper.html>, assessed on 3rd June 2016.
- <http://www.yourarticlelibrary.com/industries/paper-industry-growth-and-distribution-of-paper-industry-in-india/14193/>, assessed on 6th June 2016.
- <http://www.paperonweb.com/paperpro.htm>, assessed on 6th June 2016.
- <http://www.tappi.org/content/sarg/t494.pdf>, assessed on 7th June 2016.
- <http://www.allpack.com/StructuresDefined.php>, assessed on 8th June 2016.
- <http://www.imperialbox.net/custom-boxes-styles>, assessed on 9th June 2016.
- <http://www.bobst.com/chen/industry/packaging-folding-carton/#.VynJ0BKZtq0>, assessed on 10th June 2016.
- https://en.wikipedia.org/wiki/Paper_bag, assessed on 13th June 2016.
- <http://www.ucreative.com/inspiration/creative-packaging-excellent-designs-of-paper-bags-and-boxes/>, assessed on 13th June 2016.
- <http://www.madehow.com/Volume-1/Corrugated-Cardboard.html>, assessed on 14th June 2016.
- <http://www.fefco.org/corrugated-packaging/production-process-corrugated>, assessed on 14th June 2016.
- <http://boxmaster.com/products/box-basics/>, assessed on 15th June 2016.
- <http://www.fibrebox.org/Info/WhatIsCorrugated.aspx>, assessed on 17th June 2016.
- <http://lithotech.ca/types-of-corrugated/>, assessed on 17th June 2016.
- <http://www.webstaurantstore.com/blog/1138/types-and-sizes-of-corrugated-boxes.html>, assessed on 18th June 2016.
- <http://www.cupmachinery.com/english/process.html>, assessed on 18th June 2016.
- https://en.wikipedia.org/wiki/Paper_cup, assessed on 19th June 2016.
- <http://b2b.sulekha.com/pdf/thepapercupmachine3.pdf>, assessed on 19th June 2016.
- https://www.hallf.kth.se/polopoly_fs/1.221538!/Menu/general/column-content/attachment/F%C3%B6rel%C3%A4sning%202.pdf, assessed on 20th June 2016.

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

- Analog Substance Indicator/GSM Tester.
- Bursting Strength Tester.
- Universal Testing Machine.
- Compression Tester- ECT/FCT/RCT, etc.
- Electronic Thickness Gauge.
- Analog Puncture Strength Tester.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. Imran K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. HOD, Packaging Technology.	HOD, Packaging Technology, Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ENGINEERING SCIENCES AND TECHNICAL ARTS COURSES
COURSE CODE	: PK302E^s
COURSE TITLE	: TRADITIONAL PACKAGING MATERIALS
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs.
PR. TEE	: 02 HRs. (External)
PT. EXAM	: 01 HR.

❖ **RATIONALE:**

This course deals with packaging materials like glass, metals, wood, textiles, etc. used in the field of packaging. It covers technology involved in raw material manufacturing and conversion in to a suitable packaging material like containers, boxes, bags, etc. Knowledge of this course forms a basis to understand higher level courses and help in evaluation of packages made out of these materials for various applications.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to –

1. Identify material of manufacture and type of container.
2. Appreciate the properties and uses of packaging materials like glass, metals, wood and textiles.
3. Select the containers of various materials and confirm their suitability in place and item of use.
4. Test wood, metals, glass, fabrics, etc.
5. Operate testing machineries and measuring instruments.
6. Record the observations/ readings of testing machines and measuring instruments for drawing conclusions/inferences or calculation purpose.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Metallic Packaging	1. Define terms related to metallic packaging. 2. State the characteristics and uses of different sheets. 3. Compare various metallic sheets. 4. State applications of various forming processes. 5. Specify characteristics required in a metallic sheet for a particular application. 6. Select a particular metallic sheet for a specific application. 7. Select the manufacturing processes in manufacturing the containers. 8. Sequence the processes required to produce the containers. 9. State types of seams & joints, cans, sheets, cans, tins, caps and closures. 10. Draw labeled sketches of various types of seams & joints, cross- sections of cans. 11. Describe various manufacturing processes. 12. Describe the procedure to carry out various tests. 13. Draw various containers.	1.1 Packaging Metals (Description and uses)- Black plate, Coated sheets and uncoated sheets, Tinplate- methods of tinning-Hot dipping & Electro-Plating, Galvanized steel sheets, Mild steel sheets, Tin free steel, Aluminum and its alloys, Aluminum foil, Non-ferrous metals. 1.2 Sheets and foil manufacturing processes. 1.3 Applications of spinning, embossing, punching, shearing, drawing, deep drawing & wall ironing of metals in packaging. 1.4 Metal cans – material, construction, types of seams & joints, types of closures, types and methods of manufacturing of cans. Advantages, disadvantages & uses of steel & aluminum cans. 1.5 Aluminum collapsible tubes- Advantages, disadvantages and uses, outline of manufacturing process, specification & terminology. 1.6 Metallic caps & closure–their types, methods of manufacture, uses and applications. 1.7 Metal coatings - Thermal spraying, vapour deposition. 1.8 Steel strapping- strength & adequate elongation, Functions, Uses, merits and demerits, methods of jointing, hand tools, power strapping machine. 1.9 Stress corrosion of metals, presence of inhibitors, passivity, corrosion testing, lacquer coating. 1.10 Seamless aluminum bottles -	14

		material of manufacture, its pattern and uses.	
2. Drums, Tins & Aerosols	1. Define related terms. 2. State raw materials of construction, types, uses, advantages & disadvantages. 3. Differentiate between cans, drums, oblong tins & aerosols on various points. 4. Describe the construction of given type of metal drum, tin and aerosols. 5. Describe manufacturing of given type of metal drum, tin and aerosols. 6. Draw labeled sketches given containers. 7. Suggest suitable form for a particular application.	2.1 Metal drums- raw materials used, their types- fixed head drums, removable head drums, internally lined drums, composite drums, galvanized drums, manufacturing process and uses. 2.2 Tins - materials used, description of construction, manufacturing process and uses. 2.3 Aerosols - construction, working, advantages, disadvantages & uses.	12
3. Containerization & Returnable Containers	1. Define terms related to containers & returnable containers. 2. State the specification, purpose, uses & applications of them. 3. Distinguish containers and returnable containers from drums, tins & cans. 4. Describe the constructional features of these containers. 5. Draw the containers and label them. 6. Identify different components.	3.1 Containers (Containerization) – specification, constructional features, purpose and uses. 3.2 Returnable containers – tankers, cylinders- their constructional features, uses and applications.	08
4. Glass Containers	1. Define terms related to glass containers. 2. List the raw materials, coloring agents, types. 3. List defects found in glass containers. 4. State characteristics of various types of glass & glass containers. 5. State advantages, disadvantages & uses of various glass and glass containers.	4.1 Raw materials used, outline of manufacturing process, Coloring of glass, characteristics of glass, types of glass, types of container, advantages, disadvantages & uses of glass and glass containers. 4.2 Container making processes, defects in glass containers, treatment of glass/containers, Testing & quality control. 4.3 Recycling.	10

	6. Outline the manufacturing process of glass containers. 7. Describe various container making processes. 8. Select the type of container for a specific use. 9. Detect defects in glass containers. 10. Describe various methods of testing glass containers. 11. Identify different parts of a container.	4.4 Testing methods - thermal shock test, fragility test, dimensional accuracy, annealing test, etc.	
5. Textile sacks, Bags, Twines & Cords, Bailing & Composite Packaging	1. Define related terms. 2. List various materials of sacks & bags. 3. State nomenclature, specification, uses & applications, methods of closing. 4. State types of jute fabric, seams, applications, uses, knots & seals. 5. Describe bailing process, sack manufacturing, mailing sack & bag. 6. Describe a composite container and its manufacturing. 7. Distinguish between them. 8. Recognize material of their construction.	5.1 Material used & sack manufacture, finishing treatments, nomenclature, specification & types of jute fabric, types of seams used, uses & applications, lined sacks & bags, methods of closing sacks and bags. 5.2 Bales, bailing processes, mailing sack & bag. 5.3 Definitions & need of composite materials and composite packages, uses of these materials in packaging, advantages. 5.4 Definition of twines & cords, uses, types of knots, seals.	08
6. Wood	1. Define related terms. 2. State characteristics, class, examples, applications of wood. 3. State types of plywood & other materials used, defects in wood. 4. State various types of wooden containers & pallets. 5. Describe manufacturing of plywood, various methods of seasoning. 6. Describe constructional	6.1 The nature/characteristics of wood, Classification of wood, defects in wood, wood for box making, Application of wood as packaging material – containers & pallets. 6.2 Seasoning of wood – methods, treatment of wood. (Current standards in use). 6.3 Plywood manufacturing process, plywood specifications, types of plywood used in packaging, other materials used in box making.	12

	features of various wooden containers and/ or their manufacturing. 7. State related applications. 8. Describe how various tests are carried out. 9. Sketch pallets & wooden containers. 10. Suggest appropriate container for use. 11. Compare wooden containers. 12. Categorize various defects found in wood. 13. Classify wood for container making.	6.4 Nailed wooden boxes, simple wooden crate, wire bound boxes & crates, Sill & skid base cases & crates, sheathed crates, wooden casks and plywood kegs, plywood barrels - their construction, production methods, types & styles, methods of closing. 6.5 Testing and quality control. 6.6 Types of wooden pallets- Standard pallets, block class, stringer class, two way entry, four way entry, reversible non reversible pallets – their sketches and applications.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Measure the gauge/thickness of metallic sheet / metallic foils using micrometer.	Metallic Packaging	2
2	Determine puncture resistance of metallic sheet & foil.		2
3	Determine bursting strength of metallic sheet & foil.		2
4	Determine tensile strength & elongation of given strap.		2
5	Determine joint strength of given strap.		2
6	Identify the type of can and the type of seam and joint used in its construction.		2
7	Identify material of construction and describe method of construction of can.		2
8	Determine compression strength of metal cans.		2
9	Identify material & method of construction of drum.	Drums, Tins & Aerosols	2
10	Perform Thermal shock test of glass bottles.	Glass Containers	2
11	Perform annealing test on glass container.		2
12	Identify various defects in glass containers.		2
13	Determine nail and screw holding power of wood.	Wood	2
14	Perform static bending test on wood. OR Determination of tensile strength/ compressive strength of plywood		2
15	Determine density & moisture content of wood.		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	Metallic Packaging	02(02)	08(04)	04(00)	14(06)
02	Drums, Tins & Aerosols	02(04)	10(00)	06(00)	18(04)
03	Containerization & Returnable containers	06(00)	04(06)	00(00)	10(06)
04	Glass containers	06(00)	00(06)	04(00)	10(08)
05	Textile sacks, bags, bailing & composite packaging	02(04)	06(00)	00(04)	08(08)
06	Wood	04(02)	06(04)	00(04)	10(08)
	Total	22(12)	34(20)	14(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	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	5/7
	1	R	2																
02	3	R	4	4	R	4	6	R	4	2	R	4	5	R	4				3/5
03	1	U	4	1	U	4	2	U	4	1	U	4	6	U	4				3/5
04	3	U	4	1	A	4	4	A	4	5	A	4	6	A	4				3/5
05	5	U	6	6	U	6	3	U	6										2/3
06	2	U	6	2	A	6	4	U	6										2/3

T= Unit/Topic Number

R-Remember

L= Level of Question

U-Understand

M= Marks

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of testing equipment/ IS referred/ size of test piece/ etc.	10
2	Procedure & Performance.	20
3	Calculation, result & inference.	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	3	2	2	-	-	-	2	2	3	-	2
5	3	3	2	2	-	-	-	2	2	3	-	2
6	3	3	2	2	-	-	-	2	2	3	-	2

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

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	IS : 1394 - 1984 Glossary Of Terms Relating To Metal Containers	Bureau of Indian Standards - 1984	-
2.	IS : 10106 (Part 2/Sec 1) - 1985 Packaging Materials - Metals	Bureau of Indian Standards - 1985	-
3.	IS: 2552 -1989 Steel Drums (Galvanized And Ungalvanized)	Bureau of Indian Standards -1989	-
4.	IS 5682 : 1991 Open Top Drums And Kegs -Specification	Bureau of Indian Standards - 1991	-
5.	IS : 3101 : 1995 Aluminium Collapsible Tubes – Specification	Bureau of Indian Standards - 1995	-
6.	IS : 10106 (Part 3/Set 3) – 1985 Ancillary Materials - Tensional Strapping	Bureau of Indian Standards – 1985	-

7.	IS : 6662 – 1993 Timber Species Suitable for Wooden Packaging-Specification	Bureau of Indian Standards – 1993	-
8	IS : 10106 (Part 4/Sec 5) – 1986 Wood Based Containers	Bureau of Indian Standards – 1986	-
9	IS : 1503-1988 Specification for Packaging Wooden Cases	Bureau of Indian Standards – 1988	-
10	IS : 2674-1988 Specification for Battened Plywood Cases	Bureau of Indian Standards – 1988	-
11	Fundamentals of Packaging Technology	Walter Soroka, Institute of Packaging Professionals, Virginia.	10: 1930268254
12	Packaging in Glass	Brian Moody, Published by Ebury Press -1977	9780091294908

❖ E-REFERENCES:

- <http://www.madehow.com/Volume-2/Aluminum-Beverage-Can.html> assessed on 5th May 2016
- https://en.wikipedia.org/wiki/Tin_can assessed on 7th May 2016
- <https://www.youtube.com/watch?v=QEUV-FWZ8lM> assessed on 12th May 2016
- <https://www.youtube.com/watch?v=hcsDxCagWrY> assessed on 13th May 2016
- <https://www.youtube.com/watch?v=8yOqFbygVAQ> assessed on 15th May 2016
- <https://www.youtube.com/watch?v=Yxo4l9ZDZjc> assessed on 17th May 2016
- https://www.youtube.com/watch?v=on_oUajNso assessed on 20th May 2016
- <https://www.youtube.com/watch?v=zOHmnp3KLYM> assessed on 20th May 2016

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:

1. Thickness caliper.
2. Micrometer screw gauge.
3. Vernier caliper.
4. Thermometer.
5. Universal testing machine.
6. Bursting strength tester.
7. Puncture resistance tester.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. Imran K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. HOD, Packaging Technology.	HOD, Packaging Technology, Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. Suresh Thakur	Industry Expert, Managing Director.	Palekar Food Products, MIDC, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)



LEVEL - IV

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

C. LIST OF TUTORIALS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

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

❖ E-REFERECNES:

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

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION

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

❖ WHO CONTRIBUTED FOR THIS CURRICULUM:

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

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

This course is classified as professional course. It describes the fundamentals, facts, concepts, principles and techniques of Engineering drawing. The course illustrates techniques of drawing in an engineering field. The concepts of drawing language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. It helps to develop the idea of visualizing the actual object or part on the basis of drawings and blue prints. This course is useful in developing drafting and sketching skills of the student. This preliminary course aims at building a foundation for the further course in machine drawing and other allied courses.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES:

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

C. LIST OF ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ SCHEME OF PRACTICAL EVALUATION:

S.N.	Description	Max. Marks
	Nil	

❖ MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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

❖ REFERENCE & TEXT BOOKS:

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards, Third Reprint, October 1998	81-7061-091-2
2.	Engineering Drawing	N. D. Bhatt, Charotar Publishing house 2010	978-93-80358-17-8
3.	Machine Drawing	N. D. Bhatt & V. M Panchal, Charotar Publishing house 2010	978-93-80358-11-6
4	Engineering Drawing	D. A. Jolhe, Tata McGraw-Hill Edu. 2010	978-0-07-064837-1
5.	Engineering Drawing	R. K. Dhawan , S. Chand & co.	81-219-1431-0
6	Engineering Drawing	P. J Shaha, S. Chand & co. 2008	81-219-2964-4

❖ **E-REFERENCES:**

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

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

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

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

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

 (Member Secretary PBOS)

 (Chairman PBOS)

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

COURSE CURRICULUM

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

❖ **RATIONALE:**

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

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES:

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

Note ; - Use A2 size of drawing sheets.

C. LIST OF ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ SCHEME OF PRACTICAL EVALUATION:

S.N.	Description	Max. Marks
	Nil	

❖ MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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

❖ REFERENCE & TEXT BOOKS:

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards, Third Reprint, October 1998	81-7061-091-2
2.	Engineering Drawing	N. D. Bhatt, Charotar Publishing house, 2010	978-93-80358-17-8
3.	Machine Drawing	N. D. Bhatt & V. M Panchal, Charotar Publishing house, 2010	978-93-80358-11-6
4	Mechanical Engineering Drawing	N. S. Salunke, Tech-Max Publication,	978-93-5077-209-6
5.	Machine Drawing	R. K. Dhawan , S. Chand &co.	81-219-0824-8
6.	Machine Drawing	Sidheshwar, Tata Mc Grew Hill Publication	9780074603376

❖ **E-REFERENCES:**

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

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

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

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

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

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

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

❖ RATIONALE:

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

❖ COURSE OUTCOMES:

After completing this course students will be able to–

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

❖ **COURSE DETAILS:****A. THEORY :**

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

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

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

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

❖ SPECIFICATION TABLE FOR THEORY PAPER:

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

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

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

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

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

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

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

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

❖ **REFERENCE and TEXT BOOKS:**

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

❖ **E-REFERENCES:**

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

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

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

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

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

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK401E ^s
COURSE TITLE	: FUNDAMENTALS OF PACKAGING
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. EXAM	: 01 HR.

❖ RATIONALE:

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 we all co-exist in. It calls for overall awareness of packaging materials burden from environmental point of view.

❖ COURSE OUTCOMES:

After completing this course students will be able to –

1. Identify suppliers of packaging materials and packaging related machineries.
2. Identify features of a packaging system and search for a package having given features.
3. Identify issues related to protection of environment from packaging induced burdens and impacts.
4. Determine the characteristics of products and visualize likely damages due to various hazards to which it is subjected to.
5. Suggest appropriate method of handling a given product in its packaging.
6. Select appropriate method of transportation, handling devices.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Business Concepts	1. Define related terms. 2. Distinguish various types of business and emphasize their need. 3. Describe quality parameters. 4. State various types of quality standards and select them for appropriate use. 5. Identify a market segment. 6. Describe and distinguish between various marketing methods. 7. State advantages of branding, advertising, value addition. 8. Suggest appropriate method of advertising and appreciate the role of media. 9. State the need of investment and the effects of blocked investment.	1.1 Basic economy - Need for business, Types of business - Production, Trading, and Service. Concept of Quality. Quality parameters - functional, organoleptic, Quality Standards - types – local, industrial, national, international, etc. 1.2 Business processes - Purchasing, Production, Inspection, Quality control, Selling, Marketing, Research, Design and Development, etc. 1.3 Marketing - Concept, Market segments, Marketing methods, Retailing - retail stores & departmental stores, Direct marketing, Catalogue marketing, Network marketing. 1.4 Branding - Concept, Popular national and international brands, advantages. 1.5 Advertising - Concept, need, methods, role of media. 1.6 Finance - Concept of investment, need, investing money, efforts, resources, time. Return on investments. Effects of blocked investment. 1.7 Value addition - concept of value, benefits of value addition.	12
2. Packaging in Perspective	1. Define related terms. 2. Describe impact of packaging on commerce, society and environment. 3. Enumerate advantages and disadvantages of packaging. 4. List basic raw materials, packaging materials and identify their conversion. 5. Define and state ancillary	2.1 Definition, Economic impact of packaging. 2.2 Advantages of packaging to - customer, retailer, distributor, handler, transporters, manufacturers, society, and nation. 2.3 Disadvantages of packaging - cost, resource utilization, energy, toxicity, litter, solid	12

	packaging materials. 6. List suppliers of packaging materials and packaging related machineries. 7. Identify a particular machine. 8. List users of packaging. 9. Describe the role of various agencies in promoting packaging. 10. State the need of, advantages of and describe contract packaging. 11. Describe demographic influence of packaging.	waste, wastage, deception, convenience, enclosure, multiples, sanitation, quality. 2.4 The Business Of Packaging: a) Packaging material suppliers: Basic raw materials, materials for packaging, converting of raw materials, converting of packaging materials. b) Ancillary materials. c) Distribution. d) Packaging equipment suppliers: converting equipment, packaging machinery, packaging materials and filled packages testing machines e) Packaging users: food, non - food. f) Support services: government, universities, consultants, institutes, publications, trade associations, professional societies. g) Contract packaging. 2.5 Packaging - Today and Tomorrow: Demographic influence on packaging: growing population, shifts in definition of household units, geographic redistribution, increase in number of working women, increase in number of single living, increase in number of two earner household, cognizance by consumers of their cultural heritage.	
3. Product Characteristics	1. Define related terms. 2. Identify product characteristics. 3. List product characteristics affecting its packaging. 4. State the influence of these properties on the function of packaging.	3.1 Product Characteristics: a) Physical characteristics of the product -Physical state, Weight, centre of gravity, symmetry, fragility, rigidity, surface finish etc. b) Physiochemical characteristics of the product - Susceptibility to water, water vapour, gases,	04

		odour, heat, light, spoilage and corrosion.	
4. Packaging functions and considerations	1. Define and describe various packaging functions. 2. State the need of warehouses. 3. List types of warehouses. 4. Describe hazards of warehousing. 5. State storage and display requirements of retail and departmental stores. 6. Select method of transshipment of a product from the point of origin up to its destination. 7. Describe various transportation practices. 8. Describe hazards associated with movement, transportation, loading, unloading and distribution of packages. 9. Describe the need and methods of handling. 10. Select appropriate handling device for a given product. 11. Draw neat sketches of given handling devices. 12. Describe the working of given handling devices.	4.1 Functional Considerations of Packaging: a) Technical Functions - containment, protection (against mechanical damages), preservation (against Physiochemical damages). b) Commercial functions - sanitation, unitization, communication (Human & Machine), dispersing & dispensing, pilferage deterrence, tampering evidence, other functions like apportionment, gifts, etc. 4.2 Warehousing and Retail outlet Considerations : a) Need for warehousing, types of warehouses. b) Hazards of warehousing - stacking - types, rain, seepage, insects and rodents/animals etc. c) Storage and Display requirements of retail and departmental stores. 4.3 Transport And Distribution Considerations: a) Principal modes of transport, various practices - parcel service, mixed loads, part or full load, multi-vehicle loads, containers. b) Hazards of movements, hazards of transportation and distribution. 4.4 Handling Considerations : a) Need for handling, Situations of loading and unloading, need for transshipments, Methods of handling-manual & mechanical, handling devices. b) Loading & unloading hazards.	10
5. Product Damages	1. Define related terms. 2. State and describe the causes	5.1 Mechanical damages: a) Causes - impact, vibration,	12

	of various damages. 3. State and explain effects of various damages. 4. State examples of corrodible products, food products. 5. Describe the role of various factors which are responsible for product damage. 6. Describe various effects of food spoilage. 7. Describe various methods of product damages.	crushing, shock, etc. b) Effects – breaking, bending, cracking, scratching, distortion, deformation, dismantling, loosening, etc. 5.2 Climatic damage: a) Corrodible products: i) Principle causes of corrosion of packaged articles. ii) Factors responsible - relative humidity, moisture content & temperature, atmospheric corrosion. b) Food products : i) Causes - heat, cold, temperature, moisture contents changes, infestation. ii) Effects - food deterioration, hardening & caking, physiochemical changes, microbiological changes, chemical changes, biochemical changes. 5.3 Climatic & bio-deterioration: Bacteria & moulds. 5.4 Insects: moths, beetles, termites, rats & mice.	
6. Environmental Protection Issues	1. Define related terms. 2. Describe related terms. 3. Describe the components of environment. 4. Describe natural cycles with examples. 5. Categorize environmental impacts/burdens. 6. Enumerate the impact of conversion processes and package usage on environment. 7. List names of packaging materials along with their characteristics and	6.1 The Environment as a System: a) Environment as a system, components of the system - land, water, air, vegetation, animals and organisms, natural cycles, co-existence, evolution and struggle for existence. b) Environmental burdens, impacts due to manmade materials, products and utilization of natural resources. c) Categories of	14

	environmental strengths and weaknesses of such materials. 8. Describe the method of life cycle analysis and life cycle assessment and the inputs and outputs of it. 9. Describe various methods of waste disposal. 10. Describe waste management. 11. Describe techniques of material recovery. 12. Describe the economy and importance of recycling. 13. State the role of an environmentally responsible manufacturer. 14. Identify the impact of manufacturing processes on the environment and suggest measures to control them. 15. Describe influence of package designing and material selection on environment.	environmental impacts. d) Risk involved. 6.2 The Packaging Conversion And Using System: a) Package Conversion: resources utilization, energy consumption, generation of waste / solid waste, pollution in various stages. b) Package using: resources utilization, energy consumption, generation of waste/ solid waste, pollution in various stages. 6.3 Packaging Materials – Life Cycle Analysis and Assessment: a) Packaging Materials: i) Historical packaging materials- names and features only. ii) Conventional packaging materials names and features only. iii) Current packaging materials- names and features only. iv) Environmental strengths and weaknesses of various packaging materials. b) Life cycle analysis – concept, method, inputs and outputs. c) Life cycle assessment - definition, value, impact assessment, Evaluation of Life cycle analysis, problems in practice, future development. 6.4 Domestic Waste Disposal: a) Concept of waste & disposal. b) Techniques of waste disposal – waste	
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		minimization, composting, recycling, incineration with or without energy recovery, land filling. c) Waste management – concept, need and strategies. 6.5 Packaging Material Recovery And Recycling: a) Techniques of Recovery, mono-material systems, multi-material systems. b) Basic economics of recycling. c) Recycling of rigid plastic packages, laminates, metals, glass & paper. 6.6 Environmentally Responsible Package Manufacture a) Role of manufacturer. b) Identification & control of impacts. c) Package design and material selection. d) Manufacturing operations review.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify various national and international brand in (any two of the following) – • Cosmetics. • Pharmaceuticals. • Confectionary. • Health care products. • Food products. • Textiles. • Write a report on it which shall include their product ranges also.	Business Concepts	2
2	Search for value added products in the market. • Visit to nearby retail store/search through internet. • Write a report.	Business Concepts	2
3	Carry out group discussions to identify the basic materials of a package. • Form a group of four students. • Identify a packaging system. • Identify basic materials of container & it's different components. • Prepare a report.	Packaging in Perspective	2
4	Prepare a list of ancillary packaging materials. • Collect samples. • Prepare a report. • Submit collected samples along with the report.	Packaging in Perspective	2
5	Identify any three products each for – • Physical characteristics - Physical state, Weight, centre of gravity, symmetry, fragility, rigidity, surface finish, etc. • Physiochemical characteristics - Susceptibility to water, water vapor, gases, odor, heat, light, spoilage and corrosion. • Prepare a report.	Product characteristics	2
6	Prepare a visit report on -Transport Service Godown (recommended: TCI) OR Railway goods yard. • Observe the resources and facilities available. • Record various activities carried out therein. • Observe the methods of handling, loading, unloading, movement, storage of goods, etc. • Identify handling devices. • Measure the dimensions of any one type of containers available there. • Prepare a report.	Packaging functions and considerations.	6
7	Find out the differences between retail stores and departmental stores.	Packaging functions and	6

	• Visit at least one retail stores and one departmental store. • Observe available space, arrangement of goods for sale, number of employees engaged, method of dealing with customers, method of making payment, etc. • Note down the observations made. • Find out the differences. • Prepare a report.	considerations.	
8	Carry out group discussions to identify functions of assigned packaging system. • Form a group of four students. • Identify product characteristics. • Determine various functions of existing packaging system. • Draw a neat labeled sketch of the package. • Evaluate its existing packaging. • Prepare a report.	Packaging functions and considerations.	2
9	Determine the likely damages to the assigned products & their packaging in handling, storage & transportation through group discussions.	Product Damages	2
10	Carry out life cycle analysis of any one packaging material.	Environmental Protection Issues	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	
1	Business Concepts	02(02)	12(04)	00(00)	14(06)
2	Packaging in Perspective	02(04)	06(04)	04(00)	12(08)
3	Product Characteristics	02(04)	00(00)	00(00)	02(04)
4	Packaging functions and considerations	06(00)	04(10)	04(00)	14(10)
5	Product Damages	02(00)	08(04)	04(00)	14(04)
6	Environmental Protection Issues	08(02)	06(00)	00(06)	14(08)
	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	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	5/7
	1	R	2																
02	4	R	4	6	R	4	6	R	4	2	R	4	3	R	4				3/5
03	4	U	4	5	U	4	5	U	4	1	U	4	2	U	4				3/5
04	2	A	4	4	A	4	5	A	4	4	U	4	5	U	4				3/5
05	1	U	6	2	U	6	4	U	6										2/3
06	1	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	Identify given packaging materials.	15
2	Recommend suitable package form for a product.	15
3	Report writing/presentation	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	1	-	-	3	-	3	-	3	-	-
5	3	3	-	-	-	-	-	3	-	3	-	-
6	3	3	-	-	-	3	-	3	-	3	-	-

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

❖ **REFERENCES & TEXT BOOKS:**

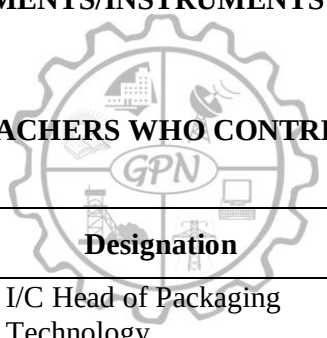
S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Introduction To Packaging	Frank A. Paine, Heather Y. Paine, Springer, Second E, 1983	978-1-4613-6214-2 978-1-4615-2810-4
2.	Packaging In The Environment	Geoffrey M. Levy, Springer, Chapman and Hall, 1993	13: 978-1461358909 10: 1461358906
3.	The Packaging User's Handbook	F.A. Paine, Chapman and Hall, New Edition, 1995	10: 075140151X 13: 9780751401516
4.	Handbook of Packaging	F.A. Paine	-
5.	Fundamentals of Packaging Technology	Walter Soroka, Institute of Packaging Professionals, Virginia	-
6.	Packaging- An Introduction	F.A. Paine	-
7.	Fundamentals Of Packaging	F.A. Paine	-

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=qAGCI0-pQ3E> assessed on 23rd May 2016
[http://atlas.massey.ac.nz/courses/EP/Section16Introduction to Packaging.pdf](http://atlas.massey.ac.nz/courses/EP/Section16Introduction%20to%20Packaging.pdf) assessed on 10th May 2016
- <https://www.youtube.com/watch?v=KMvRqygi04g> assessed on 11th May 2016
- <https://www.youtube.com/watch?v=7yAjbT5NAkE> assessed on 12th May 2016
- <https://www.youtube.com/watch?v=wugmX85ipRU> assessed on 13th May 2016
- <https://www.youtube.com/watch?v=epAh6hHOq3c> assessed on 13th May 2016
- <https://www.youtube.com/watch?v=I1E0RdHw9gU> assessed on 14th May 2016
- <https://www.youtube.com/watch?v=CdTz-26q3M8> assessed on 16th May 2016
- https://www.youtube.com/watch?v=LKW8G_AIYbw assessed on 16th May 2016
- <https://www.youtube.com/watch?v=-0w61b6wppg> assessed on 18th May 2016
- <https://www.youtube.com/watch?v=jODI07akVHM> assessed on 18th May 2016
- <https://www.youtube.com/watch?v=LCnRCfQBFO> assessed on 19th May 2016
- <https://www.youtube.com/watch?v=zCrscrELYus> assessed on 19th May 2016
- <https://www.youtube.com/watch?v=ZwAvP2lb1sU> assessed on 20th May 2016
- <https://www.youtube.com/watch?v=s5p6Nk3SzcU> assessed on 21st May 2016
- <https://www.youtube.com/watch?v=uT1hUC4JHy4> assessed on 22nd May 2016

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

NIL

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


Sr. No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr.A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. Imran K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Retired Head of Department.	Head of Department, Packaging Technology, Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Retired Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr.M.S. Deshpande	Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. Suresh Thakur	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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK402E
COURSE TITLE	: PRODUCTION PROCESSES
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 03; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE	: 03 HRs
PR. TEE	: NIL
PT. EXAM.	: 01 HR

❖ RATIONALE:

A packaging technician has to work in different capacities, for supervision of production, maintenance of packaging machines and assembly of components in packaging lines, etc. He may choose to become entrepreneur or seek employment in some industry. He has to work on different machineries in the field of production of packages. He must know the materials properties, machines and machining processes to be carried out in the manufacturing process. Study of this course will enable him to apply the concepts and knowledge of basic production processes in the field of package manufacturing and package conversion.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Select different materials and identify their properties for manufacturing a product.
2. Identify the specific machining operation to be carried out on a material for its conversion to a useful article.
3. Select various manufacturing processes for specific applications.
4. Follow safety precautions in workshop.
5. Interpret job drawing.
6. Prepare jobs according to drawing.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1.Manufacturing Processes & Materials	1. Define related terms. 2. State examples of manufactured products. 3. State with examples different materials used. 4. State the need & advantages of strengthening/ alloying of metals & plastics and common methods used. 5. List the characteristics of various materials. 6. Describe various materials used for manufacturing. 7. Describe briefly various methods of strengthening metals & non-metals. 8. Identify process or method of manufacturing. 9. State advantages of various processes. 10. Predict the behavior of given material under various loads and its failure.	1.1 What is manufacturing? Examples of manufactured products, different methods or processes of manufacturing such as cast/molded products, forged products, machined products, fabricated products, sintered & composite products. 1.2 Materials used For manufacturing -Different materials used for making these products, materials such as metals & non metals. 1.3 Metals – Ferrous & non ferrous metals, their types and composite metals. 1.4 Non Metals – (a) Polymeric materials- Natural polymers, synthetic polymers, resins, and their types, (b) Ceramic materials - glass, porcelain, graphite, insulating materials etc. 1.5 Mechanical behavior of materials in -Tension, compression, bending, torsion, fatigue, impact, creep, etc, General failures of parts/products under these loads. 1.6 Material strengthening – Alloying of metals & non metallic material, metal strengthening; metal alloys & alloying, re-enforcement, bimetal-compositing, co-polymerization & blending of polymeric compounds, re-enforcement of plastics, FRP, GRP, plastic lamination, meaning and general procedure of above processes. (Only brief description of these processes).	10

		Advantages of these processes.	
2. Welding & Related Process	1. Define related terms. 2. List the types of welding processes and their application. 3. Distinguish between various welding processes. 4. Classify welding processes. 5. State the principle of various welding processes. 6. Describe various welding techniques. 7. Describe different welding process. 8. Suggest appropriate method for a particular application.	2.1 Welding and joining, principle of welding, electrical arc welding - principle, process & welding electrodes - consumable & non consumable type, resistance welding - principle, gas welding & cutting process, soldering & brazing process, application of each in field of packaging. 2.2 Plastic welding process- heated tool welding, hot gas welding, high frequency welding, ultrasonic welding and friction welding. 2.3 Thermal welding, electron beam welding, laser beam welding, ultrasonic welding, Diffusion bonding (welding). (Principle of operation of above welding processes)	08
3. Surface Cleaning, Treatment & Coating	1. Define related terms. 2. State the need & methods of cleaning and surface preparation. 3. Mention various methods of surface coating, their advantages & applications. 4. Describe various methods of cleaning & coating. 5. Identify the type of coating. 6. Recommend a particular method for application.	3.1 Introduction, cleaning and surface preparation, surface treatment, methods of cleaning, types of surface treatment- metallic coatings, polymeric coatings, necessity of surface coating, advantages of surface coatings. 3.2 Thermal spraying, vapor deposition, diffusion coating, electro-plating, electro less plating, anodizing, hot dipping, porcelain enameling, ceramic coating, tin coating, chrome plating, nickel coating, painting, varnishing, lacquer coating, resin coating, polymer coating and applications of each in making of packages	08
4. Metal Casting Processes	1. Define related terms. 2. State materials of pattern, their properties & factors governing material selection. 3. State various types of	4.1 Pattern making- Pattern, Pattern materials and their properties, Selection of pattern materials, making of pattern, types of pattern, pattern allowances.	08

	patterns. 4. State the types & properties of moulding sands. 5. Identify various sand moulding tools. 6. Describe various pattern making allowances. 7. Describe various sand moulding processes. 8. Describe various operations in metal casting process. 9. Identify various defects in casting. 10. Draw different patterns.	4.2 Sand Molding- Sand molding, molding sand & its composition, sand preparation & sand conditioning, properties of molding sand, types of molding sand, sand molding tools, sand molding process. 4.3 Sand molding, types of sand molds, mold layout, gating and risering, cores and core making, core-prints. 4.4 Casting- Metal melting, metal pouring and casting of parts, cleaning of casted parts, defects in casting.	
5. Press Tool	1. Define related terms. 2. Describe various processes. 3. Classify presses & state their types. 4. Describe the construction of given press tools. 5. Describe various operations performed on press tools. 6. Describe sheet metal layout & economics in operations of a given component. 7. Identify presses for making small packages. 8. Identify main parts of the press and state its functions. 9. Draw labeled sketches of various presses.	5.1 Define & Describe -Shearing, drawing, ironing, spinning, bending, forming, stretch forming, embossing. 5.2 Sheet metal presses, classification of presses, types of mechanical presses used specially for making of small metallic packages, Main parts and construction of press, Functions of each part, press operation and its description. Sheet metal layout, Economics in sheet metal operation.	06
6. Metal Cutting Processes	1. Define related terms. 2. Classify general purpose tools & state their types. 3. Describe mechanism of chip formation & types of chips. 4. Describe metal cutting & surface finishing processes. 5. Describe the construction of various machines 6. Identify various parts. 7. State types & operations performed on various types of metal cutting machines.	6.1 Metal cutting- Introduction to metal cutting, Types and classification of general purpose tools, Surface finish and surface quality. 6.2 Lathe- Lathe m/c and its parts, construction of lathe, Functions of main parts of lathe, types of lathe, operations performed on lathe, Description of lathe setting and lathe operation for plain turning, taper turning, threading, drilling, boring, reaming, spinning. Spinning lathe m/c and its operational description with specific	08

	8. Describe various operations performed on metal cutting machines. 9. State the functions of various parts of various metal cutting machines. 10. Draw labeled sketches.	application in field of making of thin walled containers. 6.3 Drilling m/c- drilling m/c its parts, constructional features, types and classifications of drilling m/c, operations performed on drilling m/c. 6.4 Other general purpose m/c- flat surface machining processes such shaping, planning, slotting m/c, broaching machine, grinding machine.	
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Prepare one Wooden Pattern, Circular/Square boss with Ribs/Webs and core-prints of hollow casting using suitable allowances.	Metal Casting Processes	08
2	Prepare one sand mold and cast iron or aluminum casting using prepared pattern.	Metal Casting Processes	06
3	Prepare one job of metal cutting, comprising with following process. • Turning • Drilling. • Shaping/ Milling. • Grinding.	Metal Cutting Processes	08
4	Prepare one sheet metal job comprising following operations (Container making) • Blank preparation • Layout and marking • Sheet cutting, • Folding and Bending • Seam joining	Press Tool	08
Skill Assessment			02
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Manufacturing Processes And Materials	04(02)	04(06)	06(00)	14(08)
2	Welding and Related Process	04(04)	08(04)	00(00)	12(08)
3	Surface Cleaning, Treatment, And Coating	06(02)	04(04)	00(00)	10(06)
4	Metal Casting Processes	00(04)	12(00)	00(04)	12(08)
5	Press Tool	04(00)	04(00)	00(04)	08(04)
6	Metal Cutting Processes	04(00)	04(06)	06(00)	14(06)
Total		22(12)	36(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	1	R	2	1	R	2	3	R	2	2	R	2	2	R	2	1	R	2	5/7
	3	R	2																
02	1	R	4	1	U	4	6	R	4	2	R	4	2	U	4				3/5
03	2	U	4	2	U	4	2	U	4	4	U	4	4	A	4				3/5
04	5	U	4	2	U	4	6	U	4	5	A	4	3	U	4				3/5
05	1	U	6	1	A	6	4	U	6										2/3
06	6	A	6	6	U	6	4	U	6										2/3

T= Unit/Topic Number
R-RememberL= Level of Question
U-UnderstandM= Marks
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	40	--	Job, Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	10	--	Record	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.	05
2	Handling Tools, machineries and its operations.	15
3	Performance and Skill.	20
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	1	-	-	3	2	3	-	-
5	3	-	2	2	-	-	-	3	2	3	-	-
6	3	-	2	2	-	-	-	3	2	3	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Workshop Technology volume- I, II, III	W. A. Chapman, Routledge, 5E, 1972	9780713132694 9780713132724
2	Workshop Technology volume- I, II	Hazara and Chaudhary, Media Promoters & Publishers Pvt. Ltd., 15E, 1964	9788185099156 8185099154978
3	Workshop Technology volume- I, II	B. S. Raghuwanshi, Dhanpat Rai & Co., 2014	9780000017109 1234567144375
4	Manufacturing Technology Volume - I,II	P.N.Rao, McGraw Hill Education, 4E,2017	978-1259062575 978-1259029561
5	Manufacturing Engg. and Technology	Kalpak Jain, Pearson Education India, 4E,2002	978-9810681449
6	Production Technology	R.K.Jain, Khanna Publishers,17E,2004	978-8174090997

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=I1E0RdHw9gU> assessed on 14th May 2016
- <https://www.youtube.com/watch?v=CdTx-26q3M8> assessed on 16th May 2016
- https://www.youtube.com/watch?v=LKW8G_AIYbw assessed on 16th May 2016
- <https://www.youtube.com/watch?v=-0w61b6wppg> assessed on 18th May 2016
- <https://www.youtube.com/watch?v=jODI07akVHM> assessed on 18th May 2016
- <https://www.youtube.com/watch?v=LCnRCfQBFO> assessed on 19th May 2016

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

- Lathe.
- Drilling Machine.
- Shaper.
- Milling Machine.
- Grinding Machine.
- Carpentry operations performing equipments.
- Sheet metal work operations performing equipments.
- Molding equipments.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr.A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. Imran K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Retired Head of Department.	Head of Department, Packaging Technology, Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Retired Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr.M.S. Deshpande	Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. Suresh Thakur	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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK403E **
COURSE TITLE	: PLASTIC MATERIALS IN PACKAGING
PREREQUISITE	: CH201E
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	: 01 Hr. (Objective Type Online Examination)
PR. TEE	: 02 HRs. (Internal)
PT. EXAM	: 30 MINUTES (Objective Type offline Examination)

❖ RATIONALE:

Polymer based packaging is one of the major areas in packaging. Plastics in their various forms like flexible, semi-rigid and rigid are used for different packaging applications. Thermoplastics are mainly used for manufacture of these various forms. This course aims to provide the fundamentals of polymer science like polymerization process, additives, various types of plastics - their properties, identification & testing and adhesives & adhesive tapes.

❖ COURSE OUTCOMES:

After completing this course students will be able to-

1. Identity various thermo plastics & thermosetting plastics.
2. Select suitable plastics for packaging applications.
3. Analyze properties of plastics for various packaging applications.
4. Identify various types of adhesives & adhesive tapes.
5. Perform various plastic identification tests.
6. Conduct various tests for performance assessment.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction	1. Define the various terminologies of synthetic polymer, copolymerisation and plastics additives. 2. List properties and applications of plastic additives. 3. Describe polymerization, copolymerization and various related terminologies. 4. Describe blending and compounding of polymers. 5. State functions of plastic additives. 6. Compare different types of polymerizations & copolymerization. 7. State different functions of additives.	1.1 Genesis of polymer, what is polymer? Raw Material sources. 1.2 Polymerization process and methods of polymerization. 1.3 Molecular weight, Molecular weight and Degree of polymerisation. 1.4 Glass transition Temperature, Factors affecting glass transition temperature, Glass Transition Temperature and Melting Point, Importance of Glass Transition Temperature. 1.5 Heat Distortion Temperature, Crystallinity in polymers, Degree of Crystallinity, Effect of Crystallinity on properties of polymers. 1.6 Introduction, Meaning of copolymerisation, Purpose and uses of copolymerisation. 1.7 Free – Radical copolymerisation and Ionic copolymerisation. 1.8 Polymer alloys, Blending and Compounding of polymers. 1.9 Advantages of Copolymerisation and Blending. 1.10 The structure of Polymers, Types of Polymers, Thermo-Plastics and Thermo-Sets, 1.11 General properties and engineering applications of Thermoplastics and Thermosets,	12

		1.12 Additives and materials used in processing of plastics- Materials such as Antioxidants, Antifoaming, Antisplit, Antiblocking, Antistatic, Blowing agents, Colourants, Fillers, Lubricants, Heat stabilisers, Flame retardants, Mould release agents, Impact Modifiers, Plasticizers, Slip additives, Ultraviolet stabilizers, Optical Brighteners.	
2. Polyolefins and Polyvinyls	1. Define the various terminologies of polyolefins and Polyvinyls. 2. List general and packaging applications of polyolefins and polyvinyls. 3. Classify the polyethylene and polyvinyl compounds. 4. Describe polyolefins and Polyvinyls. 5. Identify Polyolefins and Polyvinyls. 6. Compare Polyolefins and Polyvinyls. 7. Analyze properties of Polyolefins and Polyvinyls for various packaging applications.	Identification, Properties and Uses of following compounds- 2.1 Polyolefins • Polyethylene compound. • Low density polyethylene compound. • Linear Low density polyethylene compound. • High density Polyethylene compound. • High molecular high density polyethylene compound. • Expanded polyethylene compound. • Polypropylene, Biaxially oriented Polypropylene compound. • Ethylene/Vinyl Acetate Copolymers (EVAs) compound. • Different Packaging applications of Polyolefins. 2.2 Polyvinyls • Polyvinyl chloride. • Polyvinylidene chloride. • Ethylene/Vinyl Alcohol Copolymer (EVOH) • Poly Vinyl Alcohol • Different packaging applications of Polyvinyls	10

3. Polyamides, Styrene and Ester Polymers	1. Define the various terminologies of Polyamides, Styrene and Ester Polymer. 2. List general and packaging applications of Polyamides, Styrene and Ester Polymer. 3. Classify the Polyamides; Styrene and Ester Polymer 4. Describe Polyolefins and Polyvinyls. 5. Identify Polyamides, Styrene and Ester Polymers. 6. Compare Polyamides, Styrene and Ester Polymers. 7. Analyze properties of Polyamides, Styrene and Ester Polymer for various packaging applications.	Identification, Properties and Uses of following compounds- 3.1. Polyamides • Nylon 6. • Nylon 6-6. • Nylon 6-10. • Nylon 11. • Different Packaging applications of Polyamides. 3.2. Styrene polymers • Unmodified or crystal Polystyrene. • High Impact Polystyrene • Expanded polystyrene • Acrylonitrile Butadiene Styrene (ABS) • Different Packaging applications of styrene polymer. 3.3. Ester polymers • Polyesters- Thermoplastics & Polyesters- Thermosets. • Poly-Ethylene Therephthalate (PET). • Crystalline PET (CPET). • Different Packaging applications of ester polymer.	10
4. Thermosetting Plastics, Elastomers and Other Polymers	1. Define the various terminologies of Thermosetting Plastics, Elastomer and Other Polymer. 2. List general and packaging applications of Thermosetting Plastics, Elastomers and Other Polymers. 3. Classify the Thermosetting Plastics, Elastomers and Other Polymers. 4. Describe Thermosetting Plastics, Elastomers and Other Polymers. 5. Identify Thermosetting Plastics, Elastomers and Other Polymers.	Identification, Properties and Uses of following compounds- 4.1 Thermosetting plastics. • Phenol Formaldehyde (PF resins) • Urea Formaldehyde (UF resins) • Epoxy Resins • Polyurethanes • Silicone Polymers • Different Packaging applications of thermosetting plastics. 4.2 Elastomers • Introduction. • Elastomeric materials, Fiber forming materials,	12

	6. Compare Thermosetting Plastics, Elastomers and Other Polymers. 7. Analyze properties of Thermosetting Plastics, Elastomers and Other Polymers for various packaging applications.	Properties & their Characteristics. - Elastomers and their types. - Applications of Elastomers in packaging. 4.3 Other polymers - Polycarbonate. - Acrylics- Polyacrylonitrile, High Nitrile Polymers(HNPs). - Cellulosics-Cellulose Acetate, Cellulose Nitrate. - Cellophane- Regenerated films. - Biodegradable plastics. - Ionomers. - Different Packaging applications of above other polymer.	
5. Testing of Plastics and Plastic Packages	1. Describe the various terminologies of testing of plastics. 2. List the various methods of testing. 3. Describe the various testing methods. 4. Identify suitable testing methods for plastics films and laminates.	5.1. General Tests Methods. 5.2. Identification of Plastics. 5.3. Identification of packaging films and their structure. 5.4. Testing of plastics, plastic films and laminates. 5.5. Online Monitoring Devices.	10
6. Adhesives and Adhesive Tapes	1. Define the various terminologies of adhesives and adhesives tapes. 2. State types, properties, applications of Adhesives and Adhesive Tapes. 3. List the factors affecting bond strength and adhesives used for different bonding. 4. Describe criteria for selection of adhesives and adhesive tapes, materials 5. Classify Adhesives and Adhesive Tapes. 6. Describe the process of adhesion and theory of adhesion, 7. Describe adhesives tapes and adhesion process. 8. Identify the adhesive tapes	6.1. Adhesives - Definition and Principle of adhesion. - Theories of adhesion, Bond and bond strength, Factor affecting bond strength. - Terminologies in adhesives and adhesion (Tack time, Open time, Setting time, Cure time, etc.) - Types and classification of adhesives. - Properties of specific types of adhesives. - Adhesives used in Paper-Plastic bonding. - Adhesives used in Plastic-Plastic bonding.	10

	for particular application.	• Adhesives used in Plastic-metal bonding. • Criteria for selection of adhesives tapes in packaging. • Adhesive system, Aqueous, Solvent, Emulsion, Pressure sensitive, Heat sensitive. • Advantages and disadvantages of different adhesives. • Application & uses. 6.2. Adhesive tapes • Materials of tapes. • Suitability of different tapes in particular application. • Paper tapes, plastic tapes, Leather tapes, Cloth tapes, Metal tapes, Taping systems- Gummed tapes, Pressure sensitive tapes, Heat sensitive tapes. • Advantage, disadvantage and application of different tapes. • Criteria for selection of adhesives tapes in packaging.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Perform the synthesis of polymer by addition polymerization. • Write a report.	Introduction	4
2	Determine densities of different plastic samples.	Polyolefins and Polyvinyls Polyamides, Styrene and Ester Polymers Thermosetting Plastics, Elastomers and Other Polymers	4
3	Perform the identification of different plastics by using recycling code. • Collect the different sample • Identify them as per code printed on them • Write a report		4
4	Determine the solubility of different polymers in various solvents.		4
5	Perform Identification test of different plastic by • Pyrolysis Method • PH Measurement • Specific Gravity test.		4
6	Determine tensile strength of given plastic samples using UTM machine.	Testing of Plastics and Plastic Packages	4
7	Perform slip test with plastics film. Perform dart impact test with plastic films. Perform drop test with plastic pouches.		4
8	Perform peel strength test of adhesives.	Adhesives and Adhesive Tapes	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	06(00)	04(00)	02(00)	12(00)
02	Polyolefins and Polyvinyls	04(00)	06(00)	02(00)	12(00)
03	Polyamides, Styrene Polymer and Ester Polymer.	02(00)	08(00)	02(00)	12(00)
04	Thermosetting Plastics, Other Polymer and Elastomer	04(00)	06(00)	02(00)	12(00)
05	Testing of Plastics and Plastic Packages	04(00)	06(00)	02(00)	12(00)
06	Adhesives and Adhesive Tapes	02(00)	06(00)	02(00)	10(00)
	Total	22(00)	36(00)	12(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	1	R	2	1	R	2	2	R	2	2	R	2	3	R	2	4	R	2
	4	R	2	5	R	2	5	R	2	6	R	2	1	U	2	1	U	2	2	U	2
	2	U	2	2	U	2	3	U	2	3	U	2	3	U	2	3	U	2	4	U	2
	4	U	2	4	U	2	5	U	2	5	U	2	5	U	2	6	U	2	6	U	2
	6	U	2	1	A	2	2	A	2	3	A	2	4	A	2	5	A	2	6	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 Examination 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	Selection of apparatus, writing procedure, etc.	10
2	Performance/ Skill.	20
3	Observation, Inference, Conclusion, Result, etc.	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
4	3	3	2	2	-	-	-	2	2	3	-	-
5	3	3	2	2	-	-	-	2	2	3	-	3
6	3	3	2	2	-	-	-	2	2	3	-	3

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

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Handbook of Plastic Processes	Charles A. Harper, John Wiley & Sons, Inc., First Edition, 2006	13: 978-0-471-662556 10: 0-471-66255-0
2	Plastics in packaging	A.S. Athaley, Tata McGraw-Hill, First Edition, 1992.	0-07-460014-7
3	Rigid and Semirigid Plastic containers	J. H. Boriston, Longman Group Limited, First Edition, 1994.	0-582-01491-3
4	Handbook of package engineering	Joseph F. Hanlon , Robert J. Kelsey , Hallie Forcinio, CRC Press, Taylor & Francis Group, Third Edition, 1998.	13: 978-1566763066 10: 1566763061
5	Advances in Plastic Packaging Technology	John Briston, Pira International, First Edition, 1993	13: 9780902799967 10: 0902799967
6	Plastics Packaging	Susan Selke, John Culter, Ruben Hernandez, Hanser Gardner Publications, Inc, Second Edition, 2004	13: 978-1569903728 10: 1569903727
7	Plastics in Flexible Packaging	A. S. Athaley, Multi-Tech Publishing Co., First Edition, 1992	-

❖ **E-REFERENCES:**

- https://application.wiley-vch.de/books/sample/3527409726_c01.pdf assessed on 25/08/2016
- <https://en.wikipedia.org/wiki/Plastic> assessed on 03/09/2016
- http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Material%20Science/pdf/Lecture_Notes/MLN_11.pdf assessed on 07/09/2016
- http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17764.pdf assessed on 13/09/2016
- [http://dlia.ir/Scientific/e_book/Technology/Engineering_Civil_Engineering_\(General\)/TA_401_492_Materials_of_Engineering_/020535.pdf](http://dlia.ir/Scientific/e_book/Technology/Engineering_Civil_Engineering_(General)/TA_401_492_Materials_of_Engineering_/020535.pdf) assessed on 17/09/2016
- <http://nsdl.niscair.res.in/jspui/bitstream/123456789/404/2/Basic%20concepts.pdf> assessed on 19/09/2016
- <http://authors.library.caltech.edu/25034/30/BPOCchapter29.pdf> assessed on 20/09/2016
- <http://www.ncert.nic.in/ncerts/l/lech206.pdf> assessed on 21/09/2016

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

1. Analog Substance Indicator/GSM Tester.
2. Cotton swabs and test tubes.
3. Disposable droppers or capillary tubes.
4. Alcohol burner.
5. Spool of small gauge copper wire.
6. Small piece of balsa.
7. Disposable droppers.
8. Disposable 3 or 5 ml test tubes.
9. 1 ml graduated pipettes or tuberculin syringes.
10. Pasteur pipettes.
11. Universal testing machine.
12. Compression Tester- ECT/FCT/RCT, etc.
13. Electronic Thickness Gauge.
14. Analog Puncture Strength Tester.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr.A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. A.P.Pardey	Lecturer in Paper Technology.	Government Polytechnic, Nagpur.
4.	Mr. Imran K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
5.	Mr. S.N. Madhugiri	Retired Head of Department.	Head of Department, Packaging Technology, Government Polytechnic, Nagpur.
6.	Mr. P.P. Sargaonkar	Retired Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
7.	Mr.M.S. Deshpande	Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
8.	Mr. Suresh Thakur	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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK404E^S
COURSE TITLE	: PACKAGING OF PHARMACEUTICALS
PREREQUISITE	: PK401E
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:

Pharmaceutical and personal hygiene products are the largest commercial areas in which Packaging finds its professional applications. With the advent of new remedies & increase in demand, the packaging of Pharmaceutical and personal hygiene products both are emerging as a challenge. The course contents are compiled to make the students familiar with the knowledge & skills required for selection, manufacturing and design aspects of packaging of Pharmaceutical and personal hygiene products.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Identify various types of pharmaceutical products and the factors responsible for spoilage of these products.
2. Apply the basic knowledge of working of various regulatory bodies for pharmaceuticals.
3. Select suitable materials and methods of packaging for various pharmaceutical products.
4. Identify various types of packages, closures and dispensing mechanisms.
5. Perform various tests on CR packaging.
6. Carry out package evaluation.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to pharmaceuticals and its spoilage mechanism	1. Define various terms of pharmaceuticals and its spoilage mechanisms. 2. Classify drug, its delivery system, hazards that cause spoilage, causes of pilferage. 3. Describe drug compendia, drug delivery systems. 4. Describe various spoilage mechanisms.	1.1 Definition of pharmaceuticals, types of pharmaceutical products, ethical & proprietary medicines, other classifications. 1.2 Definition of drug, vegetable and animal origin, synthetic, mineral origin. 1.3 Drug compendia, drug delivery systems. 1.4 Spoilage agents, the effect of moisture, the effect of light and oxygen, the effect of heat. 1.5 Distribution hazards, hazards of loading and unloading, movement; rail, sea, air. 1.6 Climatic and biological hazards of distribution. 1.7 Introduction - Contamination and pilferage, causes.	10
2. Solid and Semi-solid Product Packaging	1. Define various terms in Solid and Semi-solid Product Packaging. 2. Describe Solid and Semi-solid Product Packaging. 3. Classify Solid and Semi-solid Products, packaging considerations, packaging materials and systems used. 4. Draw diagrams of packages, closures and dispensing systems. 5. Compare Solid and Semi-solid Products, Packaging materials and systems. 6. Identify the packages used. 7. Evaluate the packages used.	2.1 Solid pharmaceutical products - - Types / classification, packaging consideration/ package selection. - Packaging materials and forms of containers. - Closures & dispensers. - Modern trends. 2.2 Semi-solid pharmaceutical products - - Types / classification, packaging consideration/ package selection. - Packaging materials and forms of containers. - Closures & dispensers. - Modern trends. 2.3 Evaluation of packages.	10
3. Liquid products	1. Define various terms in Liquid products & its packaging.	3.1 Types / classification, packaging	08

	- Describe liquid pharmaceutical products and its packaging considerations. - State types of materials and present packaging practices. - Draw the diagrams of packages, closures and dispensing systems. - Compare sterilization systems used. - Identify the packages used. - Evaluate the packages used.	consideration/package selection. - Packaging material, forms of containers. - Closures & dispensers. - Modern trends. - Sterilization - importance, methods. - Evaluation of packages.	
4. Child Resistant (CR) and Tamper Evident (TE) Packaging	- Define the various terminologies and concepts of CR & TE packaging. - List the types of CR & TE packaging. - Describe CR & TE packaging systems, its need / importance. - Compare CR & TE packaging systems on the basis of various points. - Identify the packages used. - Evaluate the packages used.	- Child Resistant (CR) Packaging - - Definition/Introduction, need / importance. - Typical styles of CR packaging. - Testing procedure - child test, criteria for test, child test protocol, adult test, adult test protocol, assessment of results. - Tamper Evident (TE) Packaging - - Definition / introduction, need / importance, The Tylenol case. - TE packaging requirements, current tamper-evident packaging methods, consumer evaluation approach.	12
5. Regulatory Requirements	- State the various regulatory bodies working for pharmaceuticals and their functions. - Define the various terms used in Pharmaceutical Regulatory Requirements. - Describe working of the various regulatory bodies. - Describe labeling requirements for containers and packages for human use. - Describe different environmental issues. - Identify various kinds of labels used.	- Functions/role of - Central Drugs Standard Control Organization (CDSCO), National Pharmaceutical Pricing Authority (NPPA), Drugs Controller General of India (DCGI), Indian Council for Medical Research (ICMR) and FSSAI. - Glimpses of - Drugs and cosmetics act 1940 and amendments, Schedule -T (GMP), the pharmacy act 1948, WHO (medicines). - Licensing considerations for pharmaceutical primary	12

		packaging. 5.4 Environmental issues. 5.5 Labeling requirements for containers and packages for human use. 5.6 Defective medicine report, report associated with packaging. 5.7 FDA policy guidelines for Drug adulteration.	
6. Personal Hygiene Products	1. Define the various terminologies and concepts of Personal Hygiene Products. 2. List the various examples, considerations. 3. State the various materials, containers, closing and dispensing systems. 4. Describe various types of packages and modern trends in packaging. 5. Identify the packages used. 6. Evaluate the packages used.	6.1 Definition, classification, various examples of Personal Hygiene Products, packaging considerations. 6.2 Packaging materials, forms of containers, Closures, dispensers, 6.3 Design considerations, modern trends. 6.4 Evaluation of Packages - Perfumes & Deodorants, Bathing soaps, Liquid soaps, Shampoo, Shaving cream, Face powder and Talcum powder, various creams & lotions, Hair oils, and hair dyes & hair conditioners.	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Conduct a case study on drugs of vegetable origin, animal origin, synthetic and mineral origin. - Visit a nearby medical store. - Identify & observe the products – its characteristics, go through labels and note important aspect. - Write a report.	Introduction to pharmaceuticals and its spoilage mechanism	04
2	Perform the test to find out Effect of moisture on any one type of solid pharmaceutical drug. - Identify a product. - Note its characteristics before test. (Appearance, texture, weight, etc.). - Expose it to high RH. - Observe and note its characteristics after test. (Texture, weight, etc.). - Prepare a report.		02
3	Perform the test to find out Effect of oxygen or light on any one type of pharmaceutical drug. - Identify a product. - Note its characteristics before test. (Appearance, texture, weight, etc.). - Expose it to Oxygen/atmospheric air. - Observe and note its characteristics after test. (Appearance, texture, weight, etc.). - Prepare a report.		02
4	Perform a case study on drug contamination and pilferage. - Use Internet/magazine, etc. - Search different cases on this topic, shortlist any two. - Study them and - Write a report.		04
5	Identify various types of primary containers used for packaging of solid and semisolid pharmaceutical products. - Visit a nearby medical store. - Observe the products. - Collect samples. - Write a report.	Solid and Semi-solid Products Packaging	02
6	Identify various types of closures and dispensers used for solid and semisolid pharmaceutical product. - Visit a nearby medical store. - Observe the products. - Collect samples. - Write a report.		02
7	Identify various types of primary containers used for	Liquid	02

	packaging of liquid pharmaceutical product. • Visit a nearby medical store. • Observe the products. • Collect samples. • Write a report.	products	
8	Perform child test on CR Packages. • Identify the CR Package to be tested. • Visit a nearby primary school for child test. • Conduct test & prepare a report on it.	Child Resistant (CR) and Tamper Evident (TE) Packaging	04
9	Perform adult test on CR Packages. • Identify the CR Package to be tested. • Perform the test and • Write a report. OR Identify the tamper evident techniques. • Visit a nearby medical store. • Observe the products for tamper evidence. • Collect samples. • Write a report.		02
10	Carry out a case study on Pharmaceutical labeling • Visit nearby medical stores. • Identify a product. • Read the label carefully, take photographs. • Identify the various legislative guidelines employed therein. • Write a report.	Regulatory Requirements	04
11	Identify various forms of primary containers used for Personal Hygiene Products. • Visit a nearby medical store. • Observe the products. • Collect samples. • Write a report. OR Carry out package evaluation of any one type of Personal Hygiene Product. • Identify the package/sample for evaluation. • Write a report.	Personal Hygiene Products	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	
1	Introduction to pharmaceuticals and its spoilage mechanism	06(02)	08(04)	00(00)	14(06)
2	Solid and Semi-solid Product Packaging	02(02)	06(06)	06(00)	14(08)
3	Liquid products	02(00)	08(08)	00(06)	10(14)
4	Child Resistant (CR) and Tamper Evident (TE) Packaging	04(00)	00(00)	06(00)	10(00)
5	Regulatory Requirements	04(04)	04(00)	00(00)	08(04)
6	Personal Hygiene Products	00(00)	08(04)	06(04)	14(08)
	Total	18(08)	34(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	1	R	2	1	R	2	2	R	2	3	R	2	1	R	2	5/7
	2	R	2																
02	1	U	4	4	R	4	5	R	4	5	R	4	1	U	4				3/5
03	1	U	4	3	U	4	3	U	4	3	U	4	3	U	4				3/5
04	5	U	4	6	U	4	6	U	4	6	U	4	6	A	4				3/5
05	2	U	6	2	A	6	2	U	6										2/3
06	4	A	6	6	A	6	3	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	Procedure	10
2	Suggest/Recommend/Identify	10
3	Performance	20
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	-	-
2	-	3	-	-	2	1	1	-	-	3	-	-
3	-	3	-	-	-	-	-	-	-	3	3	-
4	-	3	2	-	-	-	2	2	2	3	-	-
5	-	3	2	1	-	-	2	2	2	3	3	1
6	-	3	2	1	-	-	2	2	2	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.	Packaging of Pharmaceuticals and Personal Hygiene Products	H. Lockhart, F. Paine, Blackie Academic & Professional, 2009.	0-7514-0167-6
5.	The Wiley Encyclopedia of Packaging Technology	Kit L. Yam,, John Wiley & Sons Inc., 3E, 2010	9780470541395
2.	Pharmaceutical Packaging Technology	D A Dean, E R Evans, CRC Press, 2000.	978-0748404407
4.	Handbook of Package Engineering	J. F. Hanlon, Technomic Pub., 2E, 1992.	0-87762-924-2
3.	Packaging of Cosmetics	IIP Notes	--

❖ **E-REFERENCES:**

- https://en.wikipedia.org/wiki/Pharmaceutical_drug assessed on 03rd October 2016
- <http://journal.scconline.org/pdf/cc1972/cc023n11/p00721-p00737.pdf> assessed on 03rd October 2016
- http://www.slideshare.net/ms_optimisstic/drug-degradation assessed on 05th October 2016
- https://en.wikipedia.org/wiki/Pharmaceutical_packaging assessed on 05th October 2016
- <http://www.slideshare.net/akshayjoshi35/akshay-33890359> assessed on 07th October 2016
- http://apps.who.int/prequal/trainingresources/pq_pres/workshop_China2010/english/22/003-PharmaceuticalPackaging.pdf assessed on 09th October 2016
- <http://www.ipapharma.org/events/stability/jbhat.pdf> assessed on 09th October 2016
- <http://www.asianpharmaonline.org/pdf.php?j=2231-5659&vol=4&issue=3&ab=ab118> assessed on 10th October 2016
- <http://www.chpa.org/CRP.aspx> assessed on 11th October 2016
- https://en.wikipedia.org/wiki/Child-resistant_packaging assessed on 11th October 2016
- http://www.astm.org/COMMIT/D10Presentations/D10_-_5.pdf assessed on 12th October 2016
- <http://aglc.ca/pdf/liquor/StandardsTamperEvidentPackaging.pdf> assessed on 12th October 2016
- https://en.wikipedia.org/wiki/Tamper-evident_band assessed on 14th October 2016
- <http://www.pharmaceutical-technology.com/contractors/packaging/scandinavian-pack/> assessed on 14th October 2016
- <http://www.ipapharma.org/regulations.aspx> assessed on 17th October 2016
- <http://www.cdsco.nic.in/forms/Default.aspx> assessed on 19th October 2016
- http://www.ororagroup.com/market_solutions/personal_care_applications/market_personalcare.html assessed on 19th October 2016
- <http://www.packagingdigest.com/personal-care-packaging> assessed on 19th October 2016.

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

1. Electronic weighing scale - least count 0.01g (minimum).
2. Gas Transmission Rate/Oxygen Transmission Rate Testing Machine.
3. Humidity Chamber.
4. Electronic Weighing Machine

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK405E^s
COURSE TITLE	: PACKAGE PRINTING & AESTHETICS
PREREQUISITE	: PK401E
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:

Packaging and printing go hand in hand. Package printing & labeling are the main ways by which products are advertised and identified. Due to printing on packages the product inside are clearly identified and it is usually the first magnet that catches the customer when shopping. Information that is useful to consumers and companies such as Supermarkets is printed on packaging. This includes, ingredients, sell by dates, price, special offers, manufacturers address, contact information, product title, barcode and more.

Advertising is very important when a manufacturer launches a new or existing product. The package, through its color scheme or logo, is what is normally identified by the customer. A packaging professional must have the basic knowledge of the principles, methods used in package printing and aesthetic. This course focuses on providing the much required knowledge and skills for the students of Diploma in Packaging Technology.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Recommend suitable printing process for various packaging applications.
2. Identify printing process used on printed packages.
3. Evaluate printing work flow for various packaging applications.
4. Identify defects in printing, probable causes and remedies.
5. Perform making of few types of image carriers.
6. Design artworks for a few types of packages by using desktop computer and suitable software.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Printing Technology	1. Classify various Printing processes. 2. Define various terminologies used in printing and aesthetics. 3. Describe various elements of aesthetics. 4. Describe various ink drying techniques. 5. Identify various elements of printing technology.	1.1 Importance of Printing for packaging, Introduction to Various Printing processes, Classification, Printing Process work flow - Prepress, Press & post press. 1.2 Aesthetics - definition, importance, elements of aesthetics for packaging decoration. 1.3 Terminologies, Image carriers, types of substrates, layout, artwork, line work and halftone work, scanning, color separation, color correction, registration, process colors, special colors, Pre make-ready and make-ready, etc. 1.4 Ink drying systems. 1.5 Role of computer in Printing.	08
2. Offset Printing	1. Define various terminologies in offset printing process. 2. Describe making of different types of image carriers and equipments used in offset printing. 3. Describe construction and working principles of various types of offset printing machines. 4. Draw various machine configurations. 5. List ingredients of various kinds of offset inks & applications of offset printing process in Packaging. 6. Describe printing process flow for folding cartons and other packaging applications. 7. Compare various types of offset printing machines and	2.1 Principle of offset printing process, advantages and limitations of Offset printing process. 2.2 Image carriers – Plate material, Types of plates and plate making – Deep etch plate, Pre sensitized plates and Dri-graphic plates, Auto plate processor - construction and working, CTP i.e. Computer to plate system. 2.3 Offset printing machines - Construction and working of sheet fed offset - Single color, two color and multicolor and perfecting press. 2.4 Web fed offset – Inline, blanket to blanket and common impression press. 2.5 Offset inks - types and composition, process inks concept. 2.6 Flow chart of printed folding carton manufacturing –	14

	image carriers. 8. Identify printing method, printing defects observing prints. 9. Analyze printed material.	Designing-plate making- Printing-die cutting-finishing and packing, Applications of offset printing process in Packaging. 2.7 Printing defects in offset prints, causes and remedies.	
3. Flexographic Printing	1. Define flexography and various terminologies in flexography. 2. Describe making of different types of image carriers. 3. Describe construction and working principles of various types of flexographic printing machines. 4. Draw various machine configurations. 5. List ingredients of various kinds of flexo-inks & applications of flexography in Packaging. 6. Describe printing process flow for CFB box and other packaging applications. 7. Compare various types of flexographic printing machines and image carriers. 8. Identify printing method, printing defect seeing print. 9. Analyze printed material.	3.1 Principle of flexographic printing process, advantages and limitations of flexography. 3.2 Image carriers - Types of plates and plate making - Rubber plates, sheet photopolymer and liquid photopolymer plates, CTP i.e. Computer to plate system. 3.3 Flexographic printing machines - Construction and working of Inline press, Stack press and common impression i.e. C.I. Press. 3.4 Anilox roller - construction, cell structures and applications. 3.5 Flexo inks - Types and composition, Applications of Flexographic printing in Packaging. 3.6 Process flow of printed CFB box manufacturing. 3.7 Applications of flexography in Packaging including coating. 3.8 Defects in flexo print, causes and remedies.	12
4. Gravure Printing	1. Define various terminologies related to Gravure printing process. 2. Describe making of different types of image carriers. 3. Describe construction and working principles of Gravure printing process. 4. Draw Gravure printing machine configurations. 5. List ingredients of various kinds of gravure inks & applications of gravure in Packaging. 6. Describe gravure printing process flow for packaging	4.1 Principle of Gravure printing process, advantages and limitations of Gravure printing process. Reverse printing – concept. Sequence in multicolor printing. 4.2 Image carriers /Gravure Cylinder – construction, types Gravure cylinder making process – Chemical (carbon tissue method), Electro-mechanical and laser engraving. 4.3 Doctor blade assembly – construction and working, Electrostatic assist developments. 4.4 Applications of Gravure printing	10

	applications. 7. Compare image carriers. 8. Identify printing method seeing print. 9. Analyze printed material.	in Packaging including coating. 4.5 Gravure printing inks - Types and composition.	
5. Screen, Pad & Digital Printing Processes	1. Define various printing processes and related terminologies. 2. List advantages and limitations of various printing processes. 3. Describe different types of screen making, Screen printing process. 4. Identify various types of screens. 5. List Applications of Screen printing, inkjet, pad printing in Packaging. 6. Describe construction & working of Screen Printing machines, Pad printing unit, inkjet printing and Electro photography. 7. Draw construction of print units. 8. Identify printing method, printing defects seeing print. 9. Compare various printing processes on the basis of various points.	5.1 Principle of Screen printing, advantages and limitations of Screen printing process. 5.2 Image carrier material – Frame, fabric, filament material, types. Types of screens –Flat and circular, construction and applications, Stenciling – Direct, indirect and direct-indirect method of screen making. 5.3 Screen Printing machines – Manual, semi automatic and automatic. 5.4 Applications of Screen printing in Packaging. Screen printing inks - Types and composition. 5.5 Printing defects in screen print, causes and remedies. 5.6 Pad printing – Principle of pad printing, construction and working of printing unit, applications of pad printing, advantages and limitations. 5.7 Inkjet printing - Types, Working principle, and applications, advantages and limitations. 5.8 Electro photography - Working principle and applications.	12
6. Letterpress Printing	1. Define various terminologies in LPP. 2. Describe making of different types of image carriers, construction and working principles of various types of LPP machines. 3. List other than printing applications of LPP machines. 4. Compare various types of letterpress printing machines. 5. Identify printing method observing the prints. 6. Identify various nonprinting works which can be	6.1 Principle of Letterpress printing process (LPP), advantages and limitations of Letterpress printing process. 6.2 Image carriers - Types, composition. 6.3 Printing machines - construction & working of light platen and heavy platen machines. 6.4 Applications of LPP machines for other than printing works like die cutting, embossing, foil stamping, etc.	08

	performed on LPP machines.		
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Use desktop computer & graphics software to convert continuous tone to halftone work OR Linework to halftone work. • Take printout of the work done.	Introduction to Printing Technology	2
2	Perform digital color separation work using desktop computer & graphics editing software. • Take printout of the work done.		2
4	Design an artwork for printing on folding cartons. • Take printout of the word done. OR Perform Pre Sensitized plate making work. • Prepare a report of the process.	Offset Printing	4
5	Identify offset Printing defects. • Collect samples and • Prepare report based on causes and remedies.		2
6	Perform Sheet photopolymer plate making. • Prepare a report on process. OR Design an artwork for printing on Corrugated Fiber Board's Regular Slotted Container using desktop computer & designing software. • Take printout of the word done. OR Identify Gravure and Flexographic Prints. • Collect samples and • Prepare report based on construction & working of these printing processes.	Flexographic Printing. Gravure Printing	4
7	Prepare Screen by direct indirect method. • Prepare a report of the process.	Screen, Pad & Digital Printing Processes	4
8	Carry out Screen Printing manually(single color Job) • Take manual print/proof of the word done. OR Carry out Screen Printing manually(multi color Job) • Take manual print/proof of the word done		2
9	Identify screen printing defects. • Collect samples and • Prepare report based on causes and remedies.		2
10	Set semi-automatic screen printing machine for single color job		2

11	Carry out Laser printing work with different print settings. • Take printout of the word done.		2
	Perform line composition using letterpress types. • Take manual print/proof of the word done	Letterpress Printing	2
12	Find/ search innovation/modern trends in printing for packaging. (Students will prepare a report and will give presentation on selected topic for 05 min.)	Any topic	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 Printing Technology	02(02)	08(00)	00(00)	10(02)
02	Letterpress Printing	02(00)	10(00)	06(00)	18(00)
03	Offset Printing	02(00)	10(00)	06(04)	18(04)
04	Flexographic Printing	02(00)	08(04)	00(04)	10(08)
05	Gravure Printing	02(00)	08(06)	00(04)	10(10)
06	Screen, Pad & Digital Printing Processes	00(02)	04(10)	00(04)	04(16)
	Total	10(04)	48(20)	12(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	5	R	2	6	R	2	5/7
	1	R	2																
02	1	U	4	2	U	4	1	U	4	3	A	4	4	A	4				3/5
03	4	U	4	4	U	4	5	U	4	4	U	4	5	A	4				3/5
04	3	U	4	5	U	4	6	U	4	6	U	4	6	A	4				3/5
05	2	A	6	2	U	6	5	U	6										2/3
06	3	A	6	3	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	Procedure/sketches/workflow chart	10
2	Performance/ skill	20
3	Result/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	-	-
2	-	3	-	-	-	-	-	-	-	3	3	-
3	-	3	-	-	-	-	-	-	-	3	3	2
4	-	3	2	2	-	-	-	2	2	3	3	-
5	-	3	2	2	-	-	-	2	2	3	3	-
6	-	3	2	2	-	-	-	2	2	3	3	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Handbook of Print Media	Helmut Kipphan, Springer, 1E. 2001.	978-3-642-63142-9
2.	Printing Technology	Adams & Dolin, Delmar Cengage Learning, 5E, 2001.	978-0-7668-2232-0
3.	The Lithographers Manual	Blair, Raymond N , Graphic Arts Technical Foundation, 7E, 1983	978-0-8836-2005-2
4.	Handbook of Printing Technology	EIRI Books , Engineers India Research Institute, 2E, 2008	978-8-1867-3275-5
5.	The Wiley Encyclopedia of Packaging Technology	Marilyn Bakker, John Wiley & Sons Inc, 3E, 2008.	0471-80940-3

❖ **E-REFERENCES:**

- <http://www.pneac.org/printprocesses/flexography/> assessed on 1st September, 2016
- <http://howtobuypackaging.com/best-type-of-printing-for-packaging/> assessed on 2nd September, 2016
- <http://www.asia-print.org/Item/124.aspx> assessed on 3rd September, 2016
- <http://esl6835.cias.rit.edu/ARCHIVE/graphictype/workflow.pdf> assessed on 5th September, 2016
- https://en.wikipedia.org/wiki/Printing_industry_in_India assessed on 7th September, 2016
- <https://en.wikipedia.org/wiki/Printing> , assessed on 8th September, 2016
- https://en.wikipedia.org/wiki/Packaging_and_labeling assessed on 9th September, 2016
- <https://www.prepressure.com/printing> assessed on 10th September, 2016
- <https://s0.yellowpages.com.au/64adabfd-6462-4893-b7d5-430091d0fb39/a1-instant-printing-marrickville-2204-document.pdf> assessed on 11th September, 2016
- http://www.tappi.org/content/events/09PLACESY/Course_Papers/durling.pdf assessed on 14th September, 2016
- http://www.hubergroup.de/fileadmin/_migrated/content_uploads/INKFORMATIO_N_3_en_08.pdf assessed on 15th September, 2016.

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

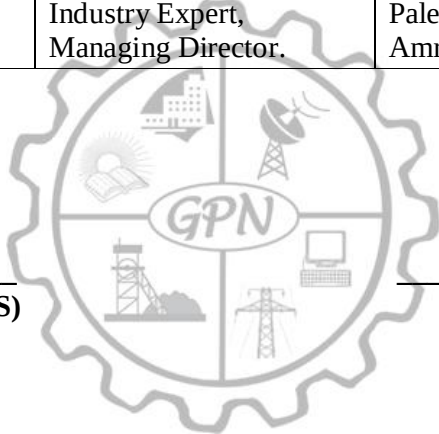
1. Single color Semiautomatic Screen Printing Machine.
2. Models of Sheet fed Offset, Flexographic and Gravure Printing Machines.
3. Desktop computers & latest designing software - Photoshop / CorelDraw / Page Maker.
4. Color Laser Printer - A4 Size.
5. UV plate exposing machine.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK406E^s
COURSE TITLE	: PLASTIC PACKAGE MANUFACTURING
PREREQUISITE	: PK403E
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:**

Packaging has become an inevitable part of our lives with its application in a wide range of industries including food and drink, healthcare, cosmetics and other consumer goods. India's plastics packaging industry is flourishing tremendously. Considering the increasing share of plastics in packaging it is necessary to deal with this segment of packaging scrupulously. Hence this course deals with various plastic processing techniques and conversions of different types of plastic materials, various types of machines and equipments used, their specifications, constructional features and setting up procedure, etc.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to –

1. Apply the basic knowledge of polymers and methods of conversion.
2. Identify various plastic conversion processes.
3. Recognize various types of plastic packages.
4. Select suitable material and method for plastic packaging.
5. Identify various equipments and components in plastic conversion machines.
6. Setting up different plastic conversion machines.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction to Flexible Films and Laminates	1. Define various terminologies in Flexible Films and Laminates. 2. List / state various forms of plastic packages, applications, types, characteristics, structure of laminates, converted forms of laminates. 3. Describe various forms of plastic packages, structure of laminates, converted forms of laminates, plastic film/ laminates manufacturing, flexible packaging material and types, selection of flexible material, positioning of different elements in laminates structure, different converted forms of composite laminates. 4. Draw the structure of flexible laminates material with positioning of different elements in it. 5. Compare/differentiate flexible and rigid packages.	1.1 Introduction to different form of plastics packages like flexible, semi rigid & rigid and their packaging applications in various sectors. 1.2 Introduction to flexible packaging materials, types of flexible materials. 1.3 Characteristics of different flexible materials, Selection of flexible materials. 1.4 Structure of flexible materials in laminate form and elements of laminate structure, positioning of different elements of flexible material in the laminate structure. 1.5 Converted forms of composite laminates.	08
2. Casting, Orientation, Coating and Lamination	1. Define the various terminologies in casting, orientation coating and lamination. 2. List/state advantages and application of cast films, oriented films, Bi-axial orientation, types of plastic film	2.1 Casting • Meaning and scope of Cast sheets/films. • Process of sheet casting. • Equipments used in sheet casting. • Casting of films and its process description. • Advantages and application of	12

	orientation, multilayer flexible composites, materials of coating & lamination, applications of laminates in flexible packaging, advantages and disadvantages of different C-L processes. 3. Describe the various processes and equipments of casting, orientation, coating and lamination, 4. Describe parameters for laminates and multilayer films. 5. Describe the selection of suitable coating and lamination process. 6. Draw labeled sketches of various processes casting, orientation, coating and lamination. 7. Compare/differentiate the casting and orientation, coating and lamination, wet and dry lamination. 8. Identify given processes, equipments, components, etc.	cast films. 2.2 Orientation - • Meaning and scope of orientation of plastic films. • Types of plastic film orientation. • Advantages and application of oriented films. • Bi-axial orientation, meaning and scope. • Advantages of Bi-axial orientation. • Applications of Bi-axially oriented films. • Equipments used in Bi-axial orientation. • Process description of Bi-axial orientation machine. 2.3 Coating - • Introduction to Coatings. • Multilayer flexible composites. • Materials of Coating. • Methods of coating- Flexographic Coating, Rotogravure Coating. • Other coating methods such as Roll coater, Nip coater, Transfer Coater, Reverse rolls coater, Knife edge coater. 2.4 Lamination - • Introduction to lamination. • Materials of lamination. • Lamination Processes- Wet lamination, Dry lamination, Heat lamination, Extrusion lamination. • Parameters for laminates and multiplayer films. • Applications of laminates in flexible packaging. • Selection of suitable Coating and Lamination process. • Advantages and disadvantages of different C-L processes.	
3. Extrusion and Co-extrusion	1. Define the various terminologies in	3.1 Extrusion - • Extrusion meaning and scope,	12

	extrusion and co-extrusion. 2. List/state the principle of extrusion and co-extrusion, Applications of co-extrusion in packaging, advantages and limitations of co-extrusion, different products formed by extrusion and their applications. 3. Describe constructional features, specifications, working of various machines, die head and conversion processes of extrusion and co-extrusion. 4. Draw labeled sketches of single screw and twin screw extruder, various extrusion and co-extrusion processes. 5. Compare/differentiate various processes. 6. Identify given processes, equipments, components, etc.	principle of extrusion. • General extrusion process and types of extrusion. • Forms of extruded products. • Plastic extrusion machine-working and constructional features. • General specifications - Capacity, Main parts of extruder- Feed system, Heating system, Barrel, Material forcing system, Orifice and Die Head. • Construction of single screw and twin screw barrel. • Extrusion process of bars, tubes, tubular film, sheets, profile shapes, etc. • Construction of die head for the above forms of extrusion. • Types of die heads. 3.2 Co-extrusion - • Meaning and scope, Principle and process of co-extrusion. • Constructional features of co-extrusion machine and die. • Advantages and limitations of co-extrusion. • Co-extrusion processes- Cast film co-extrusion, Cast sheet co-extrusion, Blown film co-extrusion, • Co-extrusion coating, Co-extrusion lamination. • Comparison of co-extrusion process with extrusion lamination and adhesive bonding. • Generalize and packaging applications of co-extrusion.	
4. Compression, Transfer and Rotational Molding	1. Define the various terminologies in compression, transfer and rotational molding. 2. List/state the principle, advantages and limitations, applications, main parts of various	4.1 Compression Molding - • Principle of compression molding. • Process description and constructional features of compression molding machine. • Compression molding die and its construction. • Advantages and applications of	10

	machines and processes. 3. Describe construction, working, main parts, mold construction and mechanism of mold rotation of compression, transfer and rotational molding. 4. Draw configurations of various molding machines. 5. Compare/differentiate /Distinguish between these processes. 6. Identify processes, equipments, components, etc.	compression molding. 4.2 Transfer Molding - • Principle of transfer molding. • Transfer molding die and its construction. • Comparison of Transfer molding and compression molding processes. • Merits and de-merits of transfer molding over compression molding. • Applications of transfer molding. 4.3 Rotational Molding - • Outline of process. • Principle of rotational molding. • Constructional features of rotational molding machine. • Mould construction and mould rotation. • Molding process of rotational molding. • Applications of rotational molding.	
5. Injection and Blow Molding	1. Define the various terminologies in the injection molding and blow molding. 2. List/state the applications of injection molding and advantages and limitations of blow molding, defects occur in injection molding, types of blow molding. 3. Describe constructional features, specifications, working of various machines of injection molding and blow molding 4. Draw configurations of various molding machines. 5. Compare/differentiate /Distinguish between these processes.	5.1 Injection Molding - • Outline of process, principle of injection molding. • Constructional features of Injection molding machine. • Main parts of injection molding machine. Description of barrel construction and different material feed mechanisms used in injection molding machine. • Constructional features of die movement. • Mould design and runner system, mold venting, Shrinkages in molding, Mould heating and cooling, Part ejection. • Complete operation and Process description of injection molding. • Applications of injection molding process and range of injection molded products.	12

	6. Identify the molding defects in injection molding and processes, equipments, components, etc.	• Possible molding defects in Injection molding. 5.2 Blow Molding - • Outline of blow molding process and principle of blow molding. • Constructional features of blow molding machine. • Blow molding mould, Mould movement. • Description of material injection system in blow molding mold. • Mold heating, Part blowing operation, Part ejection. • Types of Blow molding operations- Injection blow molding, Extrusion blow molding, Stretch blow molding. • Advantages and limitations of above types of blow molding processes.	
6. Thermoforming	1. Define the various terminologies of thermoforming. 2. List/state the elements of thermoforming, applications of thermoforming, Various Polymers molded in thermoforming. 3. Describe the different elements of thermoforming, mold arrangement in thermoforming, mold design, mold venting arrangement and various methods of thermoforming. 4. Draw configurations of various molding machines. 5. Compare/differentiate the vacuum forming, pressure forming, and matched mold forming. 6. Identify processes,	6.1 Outline the process of thermoforming, principle and Characteristics features of thermoforming. 6.2 Elements of thermoforming, Machine variables- Sheet clamping, Heating, cooling, Mould design, Trimming, Part ejection. 6.3 Types of thermoforming molds - Male and Female molds. 6.4 Mold design, Mould venting system, and Mould draft, Mould configurations. 6.5 Process description of thermoforming. 6.6 Methods of thermoforming- Vacuum forming, Pressure forming, Matched mold forming. 6.7 Processes of thermoforming - One step forming and multi step forming, Drape forming, snap back forming, Plug assist forming. 6.8 Various Polymers molded in thermoforming process.	10

	equipments, components, etc.	6.9 Applications of thermoforming. 6.10 Other Applications of thermoforming like shrink wrapping, skin packaging, process descriptions and uses in the engineering and packaging fields.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Perform a case study on flexible, semi rigid and rigid plastic packages. • Visit to nearby general stores. • Observe plastic packages. • Collect samples. • Prepare a report- collect the information on packages, material used, manufacturing process and packaging applications.	Introduction to Flexible Films and Laminates	04
2	Prepare a visit report on plastic film making process by visiting industry or by observing video/ Video CD. • Observe the processes. • Identify various parts stating their functions. • Observe the machine set up. • Prepare a report on – specifications, procedure of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.	Casting, Orientation, Coating and Lamination	04
3	Set Extrusion blow molding machine for a given job • Idle-Run Observation (IRO). • Identify various parts stating their functions. • Setting up of machine for a job. • Prepare a report on – specifications, procedure of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.	Extrusion and Co-extrusion	02
4	Prepare a visit report on compression and/ OR transfer molding by visiting industry or by observing video/ Video CD. • Observe the processes. • Identify various parts stating their functions. • Observe the machine set up. • Observe the mold clamping arrangement. • Prepare a report on – specifications, procedure	Compression, Transfer and Rotational Molding	04

	of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.		
5	Prepare a visit report on rotational molding by visiting industry OR by observing video/ Video CD. • Observe the processes. • Identify various parts stating their functions. • Observe the machine set up. • Observe the mold clamping arrangement. • Prepare a report on – specifications, procedure of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.	Compression, Transfer and Rotational Molding	04
6	Prepare a visit report on blow molding by visiting industry OR by observing video/ Video CD. • Observe the processes. • Identify various parts stating their functions. • Observe the machine set up. • Prepare a report on – specifications, procedure of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.	Injection and Blow Molding	04
7	Set injection molding machine for a given job • Idle-Run Observation (IRO). • Identify various parts stating their functions. • Setting up of machine for a job. • Prepare a report on – specifications, procedure of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.	Injection and Blow Molding	04
8	Prepare a visit report on thermoforming process by visiting industry OR by observing video/ Video CD. • Observe the operational process in industry. • Identify various parts stating their functions. • Observe the machine set up. • Noting the different variables. • Prepare a report on – specifications, procedure of operation, labeled sketch of machine parts, list of products manufactured by this process, safety precautions and processing defects & remedies.	Thermoforming	04
Skill Assessment			02
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Introduction to Flexible Films and Laminates	04(00)	04(04)	00(00)	08(04)
02	Casting, Orientation, Coating and Lamination	04(04)	04(04)	06(00)	14(08)
03	Extrusion and Co-extrusion	04(04)	08(00)	00(06)	12(10)
04	Compression, Transfer and Rotational Molding	00(02)	12(04)	00(00)	12(06)
05	Injection and Blow Molding	04(00)	04(00)	06(06)	14(06)
06	Thermoforming	02(02)	04(04)	04(00)	10(06)
	Total	18(12)	36(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	
1	3	R	2	3	R	2	5	R	2	5	R	2	6	R	2	6	R	2	5/7
	4	R	2																
2	1	R	4	1	U	4	2	R	4	2	R	4	3	R	4				3/5
3	2	U	4	3	U	4	3	U	4	1	U	4	6	U	4				3/5
4	5	U	4	6	U	4	6	A	4	4	U	4	2	U	4				3/5
5	2	A	6	5	A	6	3	A	6										2/3
6	4	A	6	4	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
		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	Procedure/diagrams/sketches	20
2	Performance/Identification of machine parts/material & conversion process.	20
3	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	-
4	-	3	-	-	-	-	-	2	2	3	3	-
5	-	3	-	-	-	-	-	2	2	3	3	-
6	-	3	1	1	-	-	-	2	2	3	3	-

1 – Slight (Low)

2- Moderate (Medium)

3- Substantial (High)

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Handbook of Plastic Processes	Charles A. Harper, John Wiley & Sons, Inc., 1E, 2006.	13: 978-0-471-662556 10: 0-471-66255-0
2	Plastics in packaging	A.S. Athaley, Tata McGraw-Hill, 1E, 1992.	0-07-460014-7
3	Rigid and Semirigid Plastic containers	J. H. Boriston, Longman Group Limited, 1E, 1994.	0-582-01491-3
4	Handbook of package engineering	Joseph F. Hanlon , Robert J. Kelsey , Hallie Forcinio, CRC Press, Taylor & Francis Group, Third Edition, 1998.	13: 978-1566763066 10: 1566763061
6	Advances in Plastic Packaging Technology	John Briston, Pira International, 1E, 1993	13: 9780902799967 10: 0902799967

7	Plastics in Flexible Packaging	A. S. Athalye, Multi-Tech Publishing Co., 1E, 1992	-
8	Plastics Packaging	Susan Selke, John Culter, Ruben Hernandez, Hanser Gardner Publications, Inc, 2Es, 2004.	13: 978-1569903728 10: 1569903727

❖ E-REFERENCES:

- <http://www.technologystudent.com/equip1/inject1.htm> assessed on 05/09/2016
- https://en.wikipedia.org/wiki/Injection_moulding assessed on 09/09/2016
- <http://www.tecni-form.com/moulding-animation.php> assessed on 05/09/2016
- <http://www.custompartnet.com/wu/InjectionMolding> assessed on 10/09/2016
- https://en.wikipedia.org/wiki/Plastics_extrusion assessed on 13/09/2016
- <http://nptel.ac.in/courses/107103012/module2/lec4.pdf> assessed on 17/09/2016
- <http://nptel.ac.in/courses/112107085/module4/lecture3/lecture3.pdf> assessed on 21/09/2016
- <http://nptel.ac.in/courses/112107085/module4/lecture7/lecture7.pdf> assessed on 27/09/2016
- <http://nptel.ac.in/courses/112107085/module5/lecture6/lecture6.pdf> assessed on 30/09/2016
- <http://nptel.ac.in/courses/112107085/module4/lecture6/lecture6.pdf> assessed on 01/10/2016
- <http://pioneer.netserv.chula.ac.th/~sanongn1/processing.pdf> assessed on 02/10/2016
- <http://www.technologystudent.com/joints/desk8.htm> assessed on 05/10/2016
- <http://www.technologystudent.com/joints/mplayer11.html> assessed on 05/10/2016
- http://samples.sainsburysebooks.co.uk/9780471786573_sample_381530.pdf assessed on 07/10/2016

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:

1. Injection molding machine.
2. Extrusion blow molding machine.

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

Sr. No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. Anup P. Pardey	Lecturer Paper Technology	Government Polytechnic Nagpur
4.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
5.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
6.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
7.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
8.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK407E ^S
COURSE TITLE	: PACKAGE DESIGN ENGINEERING
PREREQUISITE	: AM301E
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. EXAM	: 01 HR.

❖ RATIONALE:

Optimization is the key word in modern industrial economy. Arbitrarily designed and developed packages may adversely affect the cost of production & life of package and improper design may result in failure of package. Hence it is essential for packaging technicians to know the scientific method of design & developing a package. The course contents are framed to furnish the different methods and procedure for designing and developing various types of packages.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Design optimum cushioning using cushion curves.
2. Analyze the design for handling, stacking and impact loads.
3. Evaluate a designed package & packaging system.
4. Perform various tests on cushioning materials and different components of a package.
5. Carryout mathematical analysis of various forces coming into picture under different conditions.
6. Design containers of required strengths.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Introduction	1. Define various terms related to package design. 2. State various design conditions and considerations for a package 3. Describe criterion for specified impact using given type of cushioning material. 4. Determine displacement of cushioning material under impact. 5. Describe design cushioning theory. 6. Describe method of obtaining various curves of cushioning materials. 7. State applications of various curves of cushioning materials. 8. Design the package using various performance curves. 9. Determine forces and stress induced during handling, stacking and impact.	1.1 Scope of packaging field. 1.2 Role of shipping container. 1.3 Possible types of damage to container content. 1.4 Important factors that affect the design of a shipping container. (Design considerations) 1.5 Design conditions – handling loads, stacking loads and impact loads. 1.6 Definition & units of Factor of safety, Elastic constant, Spring constant. 1.7 Impact design criteria, horizontal impact, vertical cushioning displacement (Crushing type & Elastic type of cushioning material). 1.8 Calculation of impact velocity, time of fall, height of drop, deceleration during stopping after impact, force exerted by/on the packaged item, deformation of the cushioning material, total thickness of cushioning material required (for elastic type cushioning material) in case of a freely falling package. 1.9 Define and determine Load factor or G-value. 1.10 Determination of acceleration or deceleration, distance/ displacement, time in case of horizontal impacts. 1.11 Design cushioning theory. 1.12 Draw & state the applications of force-deformation curves & Energy-load curves from given data of cushioning materials. 1.13 Use of cushioning materials curves in cushion designing. 1.14 Determination of forces developed during handling, stacking and impact. (Numerical on it.)	12

2. Optimum Cushioning	1. Define related terms. 2. Describe fundamentals of cushioning. 3. Classify cushioning materials. 4. State properties of an ideal cushioning material. 5. Identify the properties of a given cushioning material. 6. State the factors influencing cushioning reliability. 7. Describe methods of reducing shock damages to products. 8. Analyze damage to packaging and its contents upon impact. 9. Describe various cushioning devices and systems. 10. Use appropriate curves in designing cushioning. 11. Describe various cushioning factors. 12. Justify cushion selection. 13. Analyze economics of optimum cushioning. 14. Calculate various parameters of cushioning.	2.1 Fundamentals of cushioning. 2.2 Importance of optimum cushioning, Objective of good cushioning design. 2.3 Cushioning materials- classification and properties. 2.4 Cushioning devices & system. 2.5 Methods of reducing damage due to shock. 2.6 Analysis of package on impact. 2.7 Significance of area under load-deflection curve, plot characteristics/ curves from data obtained experimentally: load- energy curve, Force/Energy-load curve. 2.8 Method of obtaining shock force - static weight curve from above curves. 2.9 Interpretation of thickness optimum. 2.10 Effect of increasing energy absorption to increase efficiency of a cushion without any increase in its thickness. 2.11 Cushioning factors. 2.12 Comparison of cushioning efficiencies of given cushioning materials & selection of appropriate cushioning material. 2.13 Factors affecting cushioning reliability. 2.14 Determination of effect of varying drop conditions using J factor. 2.15 Economics of optimum cushioning.	10
3. Rubber mounts, Friction dampers, Spring packages & Full suspension packaging	1. Define related terms. 2. Describe construction of various mounts. 3. State uses and characteristics of various mounts. 4. Describe the role of friction dampers. 5. Draw neat labeled sketches of mounts and dampers. 6. Design various mounts.	3.1 Tension spring package- use, construction, schematic diagram. 3.2 Full suspension package- Description of construction and its use. 3.3 Use of rubber shear mounts. 3.4 Shear sandwich mount – its sketch, construction, characteristics. 3.5 Friction dampers – definition, purpose, types. 3.5 Platform mount - its sketch, construction, characteristics.	12
4. Corrugated Fibreboard Containers	1. Define related terms. 2. State examples of fibreboard materials.	4.1 Strength requirements of fiberboard containers. 4.5 Factors affecting design of CFB box	10

	3. Describe with sketches the construction of different fibreboard containers. 4. Describe various methods of closing a fibreboard container. 5. Describe the procedure to conduct various tests. 6. State strength requirements of fibreboard containers. 7. Design a blank and sketch its layout for a given style and dimensions of a box. 8. Calculate deckle size, determine material requirement and analyze cost. 9. Evaluate the performance of fibreboard packaging. 10. Consider influencing forces on the design.	- Influence of GSM of paper/paperboard/ corrugated fibreboard, type of fluting, number of walls, bursting strength, edge crush resistance, flat crush resistance, water resistance, puncture resistance, style of box on the performance/design of box. 4.2 Blank design and blank layout - single piece and two piece blanks. 4.3 Calculation of deckle size. 4.4 Material requirement calculation for box of given specification. 4.5 Cost estimation. 4.6 Method of determination of wet bursting strength of corrugated fiberboard. 4.7 Mathematical analysis for handling loads, stacking loads and impact loads.	
5. Wooden Crates & Containers	1. Define related term 2. State materials used in construction. 3. Specify Wooden Crates & Containers. 4. Sketch various Wooden Crates & Containers. 5. Describe construction of various Wooden Crates & Containers. 6. Analyze Wooden Crates & Containers for given conditions. 7. Calculate developed load factor. 8. Determine forces on various parts & on containers.	5.1 Description of wooden crate – construction, Analysis for handling, stacking, and impact load considerations. Simple mathematical analysis like calculation of moment of inertia of composite section of such containers, stresses in struts, force exerted by a product on various members of a container, analysis of force on that member, etc. 5.2 Tools used in assembly. 5.3 Description of plywood containers (construction). 5.4 Material specifications for domestic shipment and overseas shipment. 5.5 Holding fittings and additional supports for quick assembly and disassembly and reinforcement. 5.6 Typical plywood container analysis for handling loads, stacking loads, package drop against bottom, drop against side, package drop against end, package drop against top, load factor calculations. 5.7 Description of construction of sheathed crates.	10

4. Metal Containers	1. Sketch various types of Metal Containers. 2. Describe construction of Metal Containers. 3. State its materials requirements. 4. Describe design requirements of Metal Containers. 6. Determine stresses on Metal Containers under various conditions. 7. Carryout structural analysis of given Metal Containers.	6.1 Materials requirement for reusable shipping and storage metal containers, 6.2 Design requirements – general requirements, functional characteristics, handling provisions. 6.3 Environmental requirements. 6.4 Test procedures – Drop edgewise test, drop cornerwise test, end impact test, roll over test, vibration test, stacking test, handling characteristics test, leak test. 6.5 Structural analysis.	10
Total Hrs.			64



B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Perform Load - Deformation test & plot various characteristics of cushioning material. - Design a package for deceleration using force consideration. - Design a package for impact load (Vertical drop). - Designing an optimum cushioning for package under impact load.	Introduction & Optimum Cushioning	6
2	Determine Grammage OR Puncture resistance & Wet bursting strength of fibreboard.	Corrugated Fibreboard Containers	2
3	Perform Box compression test to predict stacking height of a given corrugated box. OR Carry out Rolling test on filled fibreboard container	Corrugated Fibreboard Containers	2
4	Perform Drop test on a package	Corrugated Fibreboard Containers	2
5	Perform Vibration test on a package.	Corrugated Fibreboard Containers	2
6	Select rubber mounting (type, size & number) for a given product.	Rubber mounts, Friction dampers, Spring packages and Full suspension packaging.	4
7	Design a wooden crate for a product under given condition.	Wooden Crates & Containers	6
8	Design a metal container for a given product.	Metal Containers	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	02(02)	14(04)	00(00)	16(06)
02	Optimum Cushioning	02(00)	00(06)	12(00)	14(06)
03	Rubber mounts, Friction dampers, Spring packages & Full suspension packaging.	02(00)	00(00)	12(00)	14(00)
04	Corrugated Fibreboard Containers	02(00)	10(04)	00(00)	12(04)
05	Wooden Crates & Containers	02(00)	08(00)	00(12)	10(12)
06	Metal Containers	00(02)	04(00)	00(12)	04(14)
	Total	10(04)	36(14)	24(24)	70 (42)

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
	1	R	2																
02	1	U	4	5	U	4	6	U	4	1	U	4							3/4
03	1	U	4	4	U	4	5	U	4	4	U	4							3/4
04	1	U	6	4	U	6	2	U	6										2/3
05	2	A	12	5	A	12													1/2
06	3	A	12	6	A	12													1/2

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	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assessment	Students	Continuous	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				TOTAL	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End Of Course			End Of The Course				

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Calculate/Plot/Determine.	20
2	Design/Evaluate/Examine.	20
3	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	-	2
4	-	3	3	1	-	-	3	2	2	3	-	2
5	-	3	3	-	-	-	-	2	2	3	-	-
6	-	3	3	-	-	-	3	2	2	3	-	2

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

❖ **REFERENCES & TEXT BOOKS:**

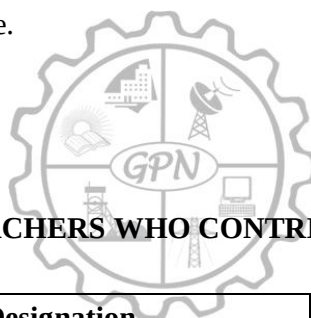
S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Packaging - An Introduction	Stanley Saccharow; HBJ Publications, 1976.	10: 0150044860 13: 9780150044864
2.	Introduction to Packaging	F.A. Paine., Chapman & Hall, Glasgow, 1992.	0216 93210 6
3.	Engineering Design Handbook - Packaging and Pack Engineering	John Wiley & Sons	978-1-61583-998-8
4.	Fundamentals of Packaging Technology	Walter Soroka, Institute of Packaging Professionals, Fourth E, 2009	1930268289 9781930268289
5.	Package Design Engineering	Kenneth Brown, John Willey & Sons, Inc Publishers, New York, 1959	-

❖ **E-REFERENCES:**

- <https://www.esko.com/en/products/overview/artioscad/overview/assessed on 26th September 2016>
- http://www.containerhandbuch.de/chb_e/stra/index.html?/chb_e/stra/stra_03_01_01_01.html assessed on 27th September 2016
- http://www.containerhandbuch.de/chb_e/stra/index.html?/chb_e/stra/stra_03_01_00.html assessed on 28th September 2016
- https://en.wikipedia.org/wiki/Crate#Wooden_crates assessed on 29th September 2016
- <http://www.woodencrates.org/standards/HDBK-252.pdf> assessed on 30th September 2016
- <https://www.youtube.com/watch?v=f1pxiNDTyHc> assessed on 03rd October 2016

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

1. Thickness caliper.
2. Grammage tester.
3. Puncture resistance tester.
4. Cobb tester.
5. Weigh balance.
6. Universal testing machine.
7. Bursting strength tester.
8. Drop tester.
9. Vibration tester.
10. Box compression tester.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK408E^S
COURSE TITLE	: LOGISTICS & SUPPLY CHAIN MANAGEMENT
PREREQUISITE	: PK401E
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. EXAM	: 01 HR.

❖ RATIONALE:

Ensuring supply of quality products and services has become vital in today's market. Good quality product must be supported by efficient and adequate packaging to retain its original properties. Supply of such properly packaged product needs distribution in an adequately planned manner to ensure right quantity and at right time.

Selection of proper mode of transport for efficient distribution is also vital from economy point of view. Tracking and location of such product during distribution is also a key factor to ensure timely and correct deliveries. Overall packaging, transportation, warehousing/stores management, coding & tracking process all go hand in hand contributing towards an effective logistic and supply chain management. It is a challenging area, knowledge of which has become an indisputable requirement of any business enterprise, hence the course.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Identify various types of transport packages.
2. Select proper mode of transportation by considering all related aspects.
3. Apply knowledge of inventory and store management.
4. Select suitable warehousing as per requirement.
5. Carry out the basic bar coding and product tracking by RFID.
6. Carryout shipment booking and select transport vehicle.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Overview of Logistics	1. Define logistic associated terms. 2. State operational objectives and functions of logistics. 3. Describe various types of logistic management	1.1 Introduction, logistics concept, operational objectives. 1.2 Components of logistics management, functions of logistics management. 1.3 Inbound, outbound and third party logistic, its characteristics and advantages.	08
2. Packaging for Transport	1. List various types of transport packages. 2. Define various terms related to transport packaging. 3. Classify containers. 4. Describe various terms related to transport packaging. 5. Describe working of various loading & unloading equipments. 6. Compare various wrapping techniques. 7. Identify various types of containers. 8. Analyze various types of containers.	2.1 Types of supply packages, unitization, Palletization, shrink and stretch wrapping, loading, unloading equipment. 2.2 Containerization - Terminology, container dimensions and weights, sizes, type code, operational markings and its arrangements. 2.3 Classification of containers, advantages of containerization, management of container services.	08
3. Transportation Systems	1. State various modes of transportation. 2. Describe various transportation systems. 3. Identify the criteria for selection of transportation mode & transportation network. 4. Analyze transportation models by solving numerical.	3.1 Transportation system - Road, Rail, water, air, pipelines, ropeways, etc. comparison, elements of transportation cost, multi-modal transport, selection of transportation mode, transportation network. 3.2 Transportation model, optimization - simple numerical.	08
4. Inventory and Warehousing	1. Recall meaning, types, and need of inventory. 2. State the concept, types, function, and facilities required for warehousing, 3. List elements of warehousing and characteristics of	4.1 Inventory - Introduction, concept, types, inventory costs, functions of inventory in logistics and supply chain management, inventory management. 4.2 Types of warehouse, concept	08

	warehousing cost. 4. Describe cost related with inventory & inventory management. 5. Identify various type of warehousing. 6. Evaluate warehousing cost.	of warehousing, functions of warehousing, characteristics and warehousing facilities requirements, elements of warehousing cost, operational mechanism of warehouse.	
5. Physical Distribution & Product Identification	1. Define PERT and CPM, Bar Code RFID. 2. List various types of product identification systems. 3. Describe distribution channel & resource planning. 4. Describe various types of product identification systems. 5. Identify Product Identification systems. 6. Evaluate basic problems on PERT and CPM & transportation model.	5.1 Distribution channels, Distribution, Resources planning master scheduling, CPM & PERT charts. 5.2 Simple numerical on transportation model, CPM & PERT. 5.3 Bar code- concept, types, generation and applications. 5.4 RFID-Concept, principle, types and application.	08
6. Supply Chain Management	1. Define various terminologies in supply chain management. 2. State concept, importance, examples and elements of supply chain. 3. Describe e-shopping. 4. Describe supply chain management. 5. Compare conventional and modern methods of supply. 6. Identify Elements of supply chain. 7. Analyze examples of role of different components in supply chain management.	4.3 Definition of Supply chain management. 4.4 Importance of supply chain flows; Examples of supply chains. 4.5 Elements of supply chain; summing role of different components involved in supply chain management; case studies. 4.6 Role of IT in supply chain; Supply chain IT framework. 4.7 Introduction to application of logistic and supply chain management in e-shopping.	08
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Carry out analysis of a standard container for its dimensions. • Visit to transporter. • Identify container for measurement. • Observe accessories, attachments, mountings, and internal tying facilities and closing and sealing arrangements in it. • Prepare a report on it.	Transportation System And Management	04
2.	Select proper transport for assigned product. • Note down package size, weight, number of packages, delivery destination and delivery period. • Form groups of four students each. • Find out possible alternatives. • Assign one alternative per batch. • Find transportation charges. • Collect information on terms and conditions compulsory/optional and other overheads. • Compile, compare the collected data and select proper transport.	Transportation System And Management	04
3.	Carry out a case study on warehousing. • Visit to a ware house/store. • Observe warehousing practices. • Prepare a report on it.	Inventory And Warehousing	04
4.	Carry out a case study on “Inventory Management” in small/medium scale industry. • Visit to a ware house/store. • Observe Inventory management practices. • Prepare a report on it.	Inventory And Warehousing	04
5.	Carry out a case study on distribution practices for a consumer product- • Visit, to Refrigerator/Air Conditioner/Television distributor. • Collect information about practices a distributor follow for distribution of product. • Prepare a report on it.	Physical Distribution & Bar-Coding and Identification Techniques	02
6.	Find out distribution channels for perishable products. • Identify products and its characteristics. • Identify origin & destination. • Gather information on existing practices. • Prepare a report on it.	Physical Distribution & Bar-Coding and Identification Techniques	04
7.	Perform bar code generation, scanning OR Verify practices followed for RFID at visited	Physical Distribution &	04

	place. • Visit to a user of Bar-code or RFID. • Observe practices followed by user. • Collect information on barcode/RFID type. • Generate barcode and tag it, add information on tagged product/identify RFID type, list advantages and disadvantages for that product. • Prepare a report.	Bar-Coding and Identification Techniques	
8.	Carry out a case study on use of logistic and supply chain management for e-shopping. • Search for available options for e-shopping. List them, note down type of commodity handled by e-shopper. • Collect information on practices followed by e-shopping for storage & distribution, delivery period & variable charges on delivery period. • E-commerce practices. • Prepare a report.	Supply Chain Management	04
		Skill Assessment	02
		Total Hrs.	32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Overview of Logistics	10(00)	00(04)	00(00)	10(04)
2	Packaging for Transport	00(02)	12(06)	00(00)	12(08)
3	Transportation Systems	00(04)	06(04)	06(00)	12(08)
4	Inventory and Warehousing	08(04)	04(04)	00(00)	12(18)
5	Physical Distribution & Product Identification	00(00)	06(00)	06(06)	12(06)
6	Supply Chain Management	04(02)	08(04)	00(00)	12(06)
	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	1	R	2	1	R	2	1	R	2	4	R	2	4	R	2	2	R	2	5/7
	6	R	2																
02	1	R	4	2	U	4	2	U	4	3	R	4	1	U	4				3/5
03	2	U	4	4	R	4	4	U	4	4	R	4	3	U	4				3/5
04	6	R	4	6	U	4	6	U	4	4	U	4	6	U	4				3/5
05	3	U	6	3	A	6	2	U	6										2/3
06	5	U	6	5	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	Performance/Actual efforts taken by student for collection of data from field visits.	20
2	Presentation/Analysis.	20
3	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	3	-
5	-	3	2	-	-	-	-	2	2	3	3	-
6	-	3	2	-	-	-	-	2	2	3	3	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ REFERENCES & TEXT BOOKS:

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Supply chain management	Sunil Chopra and Peter Meindl, Education., 8E, 2009	81-297-1072-3
2.	The Management of Business Logistics	Coyle, Birdie, Langley Jr. Thomson S W Publish., 2001.	978-0324007510
3.	Supply Chain Logistics Management	D. Bowersox, David Closs, Tata McGraw Hill , 2003	9780071232074
4.	Logistics Management	Bhattacharya S.K., S. Chand Co., 2010	8121928850
5.	Logistics Management	Shardul Chaubey, Discovery Publishing House Pvt.Ltd.	8183567940

❖ **E-REFERENCES:**

- http://www.containerhandbuch.de/chb_e/stra/index.html assessed on 7th November 2016.
- <https://prezi.com/cto29tsofuwk/market-logistics-and-supply-chain-management/> assessed on 7th November 2016.
- https://books.google.co.in/books?id=5fOPkttS0KcC&pg=RA1-PA223&dq=packaging+method+for+packages+of+product&hl=en&sa=X&redir_esc=y#v=onepage&q=packaging%20method%20for%20packages%20of%20product&f=false assessed on 9th November 2016.
- <http://www.slideshare.net/DENNYJOTTARACKAL/objectives-of-supply-chain-management> assessed on 10th November 2016.
- <http://www.slideshare.net/neilpereira/logistics-scm> assessed on 12th November 2016.
- http://www.slideshare.net/vikram_dahiya/logistics-and-supply-chain-12938486?related=1 assessed on 13th November 2016.
- <http://study.com/academy/lesson/physical-distribution-in-marketing-definition-functions-importance.html> assessed on 13th November 2016.

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

- Measuring Tape.
- Weighing Machine.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. Suresh Thakur	Industry Expert, Managing Director.	Palekar Food Products, MIDC, Amravati.

(Member Secretary PBOS)

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GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK409E
COURSE TITLE	: PACKAGE MAKING
PREREQUISITE	: PK401E
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. EXAM	: NIL

❖ RATIONALE:

This course deals with conventional packaging materials and manufacturing of models of various types of packages, development of surfaces of cartons, boxes, bags, and special purpose packages. Cushioning aspect, strength aspect, aesthetic aspect, material requirement, and manufacturing difficulties are also covered in this course so that the students of packaging technology should get substantial knowledge of package making.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Identify various types of packaging materials and packaging process.
2. Select the materials as per need of packaging application.
3. Design and construct material layout of a package.
4. Plan material requirements package making.
5. Create model of package and predict actual difficulties to be faced while it's manufacturing.
6. Conduct various tests for package evaluation.

❖ **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 a model/prototype of RSC Box of given size. • Draw blank drawing of RSC box. • Recognize manufacturing process. • Write sequence of operations. • State material specification. • List material requirement, etc. • Prepare a report.		08
2.	Create a model / prototype of any one type of carton of given size. • Draw blank drawing of RSC box. • Recognize manufacturing process. • Sequence the operations. • Note material specification & material requirement. • Prepare a report.		08
3.	Design and prepare specialty carton for an imaginary product. • Specify material details. • Manufacturing operation. • Plan manufacturing procedure. • Blank detail drawing. • Prepare a report.		08
4.	Prepare samples of two types of paper bags and plastic bags each. • Draw details of blank drawing for each type. • Practice welding of plastic materials. • Distinguish welding abilities for different materials. • Prepare a report.		06
5.	Carryout case study comprising of manufacturing economics for the same sized of folding carton but with different design and layout. • Compare material requirement, paper utilization factor, material cost and manufacturing cost. • Prepare a report.		08
6.	Carry out a case study on manufacturing economics - Same sized corrugated boxes of different styles/type.		08

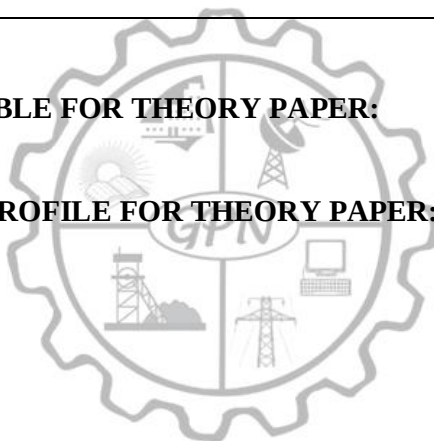
	• Compare add on benefits of each box type, material requirement, paper board utilization, material cost, weight and manufacturing cost. • Prepare a report.		
7.	Design of label for an imaginary product. • Recognize mandatory requirements of label. • Develop artistic skill and attractive designing aspect. • Prepare a report.		08
8.	Carry out a case study by comparing two existing packages for the same product. Collect products packages. Recognition of present practices of materials and their compositional requirements. Comparing and selecting best combination of packages		08
Skill Assessment			02
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 &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	Procedure/sketches/drawings	10
2	Performance / skill	20
3	Result/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	3	3	3	-
2	-	3	3	-	-	-	-	3	3	3	3	-
3	-	3	3	3	-	-	-	3	3	3	3	-
4	-	3	3	-	-	-	-	3	3	3	3	-
5	-	3	3	3	-	-	-	3	3	3	3	-
6	-	3	3	3	-	-	-	3	3	3	3	1

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

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Fundamentals Of Packaging	F.A. Paine, The Institute of Packaging; Revised Ed edition, 1981.	978-0950756707 0950756709
2.	Packaging users Handbook	F.A. Paine, Springer, 1991.	9780751401516 978-1-4613-1483-7
3.	The Wiley Encyclopedia of Packaging Technology.	Marilyn Bakker, John Wiley & Sons Inc. Canada	0471-80940-3
4.	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, 2E, PHI LPL, 2014.	978-81-203-5054-0

❖ **E-REFERENCES:**

- <https://www.unitedbags.com/c-5-multiwall-paper-bags.aspx> 11th September 2016.
- <https://www.youtube.com/watch?v=TFZ4HOPo-k0> 11th September 2016.
- <https://www.youtube.com/watch?v=iGWEUq1857g> 16th September 2016.
- http://www.dwpworks.com/NewSite/KindsPurpose_SkidsPallets.htm 17th September 2016.

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

- Electronic weighing balance/ substance indicator.
- Universal Testing Machine.
- Cobb Tester.
- Micrometer.
- Compression Tester.
- Model /simulated/ portable liquid volumetric filling machine.
- Model /simulated/ portable constant level filling machine.
- Model /simulated/ portable machine of product filling by count.
- Computer systems with internet.
- Portable bar sealing equipment.
- Model / simulated/ portable vacuum packaging machine.
- Creasing and slitting machine.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
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(Member Secretary PBOS)

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GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES
COURSE CODE	: PK410E
COURSE TITLE	: PACKAGING ECONOMICS & VALUE ENGG.
PREREQUISITE	: PK401E
TEACHING SCHEME	: TH: 01; TU: 00; PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 03(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs. (Internal)
PT. EXAM	: NIL

❖ RATIONALE:

Packaging is an add-on cost to the product, which is always over and above the factory cost, even though it serves the purpose of product protection, safe delivery, loss of damage and faith end user damage. Economics play a vital role packaging activity. Economic viability is critical factor to success of any technology. Packaging, being a mass scale activity, economic aspect is an important requirement. Packaging economics, costing of packages, value addition, loss due to packaging material waste during package conversion, recycling of packages are the key factors. Changes in packaging design and use of substitute packaging material are instrumental in achieving the economy and value addition to packaging industry. The subject is prepared to get insight of economic consideration during packaging process.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Select appropriate techniques and procedure to perform value engineering exercise.
2. Carry out the costing for different packages.
3. Select appropriate criteria to achieve economy in packaging.
4. Determine the impact of recycling/reuse of packaging materials on package economics.
5. Conduct the value engineering exercise for the assigned product / package.
6. Prepare case study report.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1 Introduction to Value Engineering	1. Describe various techniques and procedures of value engineering.	1.1 Introduction to Value Engineering. 1.2 Concept, utility and benefits of value engineering. 1.3 Value engineering - technique & procedure. 1.4 Various phases of value engineering techniques, creative phase. 1.5 Brainstorming and other techniques of creativity.	03
2 Value Engineering Organization	1. Describe value engineering exercise	2.1 Organizational aspect of value engineering. 2.2 Value engineering exercise.	02
3 Economics in production	1. Describe the role of packaging in national economy	3.1 Introduction to production economics. 3.2 Packaging economics and production economics interrelationship. 3.3 Role of packaging in national economy.	02
4 Packaging Material Cost	1. Determine packaging material cost.	4.1 Packaging materials and packaging material cost. 4.2 Packaging material and its effect on packaging cost. 4.3 Wastage of packaging material during manufacturing. 4.4 Relation of packaging cost and percentage lost in packaging materials	03
5 Packaging in Economics	1. Describe the effect of improvement in packaging design.	5.1 Packaging in general economy. 5.2 Total packaging cost, transport cost, functional or protective packaging. 5.3 Effect of improvement in packaging design. 5.4 Substitute of resources. 5.5 Recycling resources	03
6 Costing of Various Packages.	1. Determine the costing of various packages.	6.1 Importance of costing. 6.2 Different types of costs, direct cost, indirect cost (overhead), Prime cost, and factory cost of production, total cost. 6.3 Cost verses price, steps in	03

		costing procedure. 6.4 Computation of cost for different packages like CFB, aluminum cans, containers, Bottles, Closures, Rigid Carton, Folding Carton etc.	
Total Hrs.			16

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Pr.No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Carry out a case study on Value engineering. It includes - - Value engineering techniques. - Value engineering procedures. - Brain storming session for creative aspect. - Prepare a report.	Unit 1	14
2.	Carry out a case study on illustrating costing procedure of any one package such as CFB packages, Aluminum Container, glass/pet Bottles, Closures, etc. - Value engineering techniques. - Value engineering procedures. - Brain storming session for creative aspect. - Prepare a report.	Unit 4	12
3.	Carry out a case study on economic packaging materials. - Selection criterion. - Prepare a report.	Unit 6	12
4.	Carry out a case study to study effect of recycling/reuse of packaging materials on package economics. Prepare a report.	Unit 4	12
5.	Perform a case study on balancing or BEP for value and cost of product Prepare a report.	Unit 5	12
Skill Assessment			02
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 &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	Procedure/sketches/drawings.	10
2	Performance	20
3	Report writing	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	-	-	1	-	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)

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Creating Value Through Packaging: Unlocking a New Business and Management	By Jim Peters, Brian Higgins, Michael Richmond, 2012	978-1605950877
2.	Value Engineering: Analysis and Methodology (Cost Engineering) Hardcover	Del Younker, CRC Press; 1 edition, 2003	978-0824706968
3.	Introduction to Packaging	F.A. Paine.	--
4.	YCMOU, University Learning Material	MBA Curriculum, M.S. 5 Block	--
5.	Learning materials	IIP packaging volumes	--

❖ **E-REFERENCES:**

1. <https://books.google.co.in/books?id=XmKTwbgpFI4C&printsec=frontcover&dq=books+value+engineering+packaging+economics&hl=en&sa=X&ved=0ahUKEwiOw4O096TPAhUG2mMKHZEcCRoQ6AEIQTAG#v=onepage&q&f=false> assessed on 08 December 2016.
2. https://books.google.co.in/books?id=Mtq_qunJIBMC&printsec=frontcover&dq=books+value+engineering+packaging+economics&hl=en&sa=X&ved=0ahUKEwiOw4O096TPAhUG2mMKHZEcCRoQ6AEIGzAA#v=onepage&q&f=false assessed on 08 December 2016.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**
Nil❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES (PROJECT COURSES)
COURSE CODE	: PK411E^s
COURSE TITLE	: PACKAGING PROCESSES
PREREQUISITE	: 50 CREDITS
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2CLOCK HR.)
TH. TEE	: NIL
PR. TEE	: 02 HRs. (External)
PT. EXAM	: NIL

❖ **RATIONALE:**

Mechanical packaging is essential for mass production of any commodity to be economically viable. Thus all over the world complex processes, machineries and equipments are being developed. Our packaging technicians will have to be able to understand the concepts and working principles of packaging machines/systems to operate, control, set, adjust and maintain. This course covers a classified process schedule and the mechanism employed in so that an insight will be developed among students to understand the complexity of modern automatic packaging systems.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to -

1. Operate various portable machines for simulation of different packaging processes.
2. Use internet and other learning resources for searching data related to packaging processes.
3. Identify various types of packaging materials and packaging processes.
4. Perform physical packaging of products.
5. Conduct various tests for package evaluation.
6. Record the observations and prepare reports.

❖ **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 liquid filling by model /simulated/ portable liquid volumetric filling machine. - Prepare a report. OR Perform liquid filling by model /simulated/ portable constant level filling machine. - Prepare a report on the same.	Product Filling	04
2.	Perform dry product filling by filling by weight model /simulated/ portable machine. - Prepare a report. OR Perform dry product filling by filling by count model /simulated/ portable machine. - Prepare a report.		04
3.	Carry out a case study on wrapping and bundling. - Use magazines, books and internet. - Collect information on types, material, process, etc. - Prepare a report on.	Wrapping and bundling	04
4.	Identify various types of wrappings and wrapping material used in Packaging - Use magazines, books and internet. - Collect information on types, material, etc. - Prepare a report.		04
5.	Perform shrink wrapping by model / simulated/ portable machine. Prepare a report on the same		04
6.	Carry out a case study on various styles of plastic pouches. - Use magazines, books and internet. - Collect information on types, material, etc. - Prepare a report.	Form Fill Seal	04
7.	Carry out a case study on Vacuum packs and Blister pack for tablets/toys/stationery items. Collect samples.	Vacuum packaging	04

	• Use internet/magazines/books. • Analyze - material, caliper, gsm, BS. • Prepare a report on the same.		
8.	Perform vacuum packaging by model / simulated/ portable vacuum packaging machine. • Prepare a report on the same.		02
9.	Carry out a case study on various styles of paper bags. • Use magazines, books and computer system with internet. • Collect related information. • Prepare a report on the same	Bag making	04
10.	Perform Creasing and slitting/cutting on Corrugated Fiber Board. • On creasing and slitting machine. • Prepare a report on the same.	Box making	02
11.	Perform CFB box packaging (erection, loading and sealing) manually. • Prepare a report.		02
12.	Carry out package evaluation of any two styles of folding cartons. • Use internet/magazines. • Collect samples. • Analyze – style, dimensions, paper type, gsm, caliper, BS/Cobb. • Prepare a report.	Folding cartons	04
13.	Perform die cutting (a folding carton) using flat die manually or using model of light platen machine. • Prepare a report on the same		04
14.	Identify standard wooden pallets (Block class and Stringer class) - • Observe • Take physical measurements of each component of the pallets and • Prepare a report on the same.	Palletizing, strapping and stretch wrapping	04
15.	Perform Palletizing work on any one of the above pallets. • Prepare a report on the same		04
16.	Perform stretch wrapping of above palletized pallet by model / simulated/ portable stretch wrapping machine. • Prepare a report on the same. OR Carry out stretch wrapping material evaluation. • Collect samples • Analyze – gsm, tensile strength, elongation. • Prepare a report on the same.		04
17.	Perform strapping of above stretch wrapped pallet using hand tools and steel or plastic strapping. • Prepare a report on the same		04

	OR Carry out strapping material evaluation. • Collect samples • Analyze –material, tensile strength, thickness elongation. • Prepare a report on the same.		
Skill Assessment			02
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	--	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	Procedure/sketches/drawings	10
2	Performance / skill	20
3	Writing Report	10
4	Viva voce	10
TOTAL		50

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

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

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

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Fundamentals of Packaging	F.A. Paine , The Institute of Packaging; Revised Ed edition, 1981.	978-0950756707 0950756709
2.	Packaging Users Handbook	F.A. Paine , Springer, 1991.	9780751401516 978-1-4613-1483-7 (Online)
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, 2014.	978-81-203-5054-0
7.	Packaging Machinery Operations Series	C. Glen Davis, PMMI, USA, 1991.	--

❖ **E-REFERENCES:**

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- [https://en.wikipedia.org/wiki/Filler_\(packaging\)](https://en.wikipedia.org/wiki/Filler_(packaging)) website assessed on 3rd September 2016.
- <http://collections.infocollections.org/ukedu/en/d/Jto01ae/6.1.html> 5th September 2016.
- <http://www.aaapackaging.bz/net%20weigh%20filling%20machines%20guide.htm> 5th September 2016.
- <http://www.awe.com.au/packaging-machinery/auger-fillers/vertical-auger-fillers/> 7th September 2016.
- <http://www.fillers.com/time-gravity-filling-machine/> 7th September 2016.
- <http://www.fillers.com/piston-filling-machine/> 7th September 2016.
- <http://www.involvo.com/PackagingStyle/ShrinkWrappingStyle> 09th September 2016.
- http://www.folplast.hu/en/collation_shrink_films.html 09th September 2016.
- <http://www.emc.com.ph/afleong/benison/shrproc.html> 09th September 2016.
- <https://packagingblog.org/tag/centerfold-shrink-wrap/> 09th September 2016.
- <https://www.plasticpolybags.com/printed-poly-bag-c-162.html> 10th September 2016.
- <https://www.bagsandpouches.sg/vacuum-bags/> 10th September 2016.
- <http://www.slideshare.net/crystaldoll79677/vacuum-packaging-of-food> 10th September 2016.
- <http://www.bagboxpackaging.com/paper-bags.html> 11th September 2016.
- <https://www.unitedbags.com/c-5-multiwall-paper-bags.aspx> 11th September 2016.
- <https://www.youtube.com/watch?v=TFZ4HOPo-k0> 11th September 2016.
- <https://www.youtube.com/watch?v=iGWEUq1857g> 16th September 2016.
- http://www.dwpworks.com/NewSite/KindsPurpose_SkidsPallets.htm 17th September 2016.
- <http://www.malaysiaexports.com/inex18.1.pallet.htm> 17th September 2016.
- <http://www.1001pallets.com/pallet-safety/> 17th September 2016.
- http://www.wikiwand.com/en/Stretch_wrap 21st September 2016.
- <http://pscl.myshopify.com/collections/pokas> 21st September 2016.
- <https://www.youtube.com/watch?v=m-JwQq8hHHs> 21st September 2016.
- <http://contimeta.com/en/catalog/packaging-system/plastic-strap> 21st September 2016.
- <http://www.slideshare.net/naveenaugust/packaging-labeling-in-food-industries> 25th September 2016.
- <https://www.pinterest.com/pin/258745941064286677/> 25th September 2016.

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

- Electronic weighing balance/ substance indicator
- Universal Testing Machine.
- Cobb Tester.
- Micrometer or Thickness Caliper.
- Compression Tester.
- Model /simulated/ portable liquid volumetric filling machine.
- Model /simulated/ portable constant level filling machine.
- Model /simulated/ portable machine of product filling by count.
- Computer systems with internet.
- Portable bar sealing equipment.
- Model / simulated/ portable vacuum packaging machine.
- Creasing and slitting machine.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES (PROJECT COURSES)
COURSE CODE	: PK412E
COURSE TITLE	: CASE STUDY
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. EXAM	: NIL

❖ **RATIONALE:**

In today's world of competition it is has become the need of time to enrich the students with different skills. Industry today is demanding versatile ready to use skilled manpower. Hence this course deals with different case studies include, introductory part of research, how to behave at job place, engineer and societal responsibilities, waste management, etc. And a bit introductory work has been given which will help students deal upcoming subjects smoothly.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to -

1. Create a few formats of Case Study and Technical Report.
2. Carry out Problem Analysis for given problems.
3. Carry out Survey on Professional Etiquette.
4. Identify Printing Processes used for Packaging & Distribution Channel for FMCG products.
5. Create Questionnaire & Interview the Engineers devoted to the Society.
6. Demonstrate Recycling of Packaging waste.

❖ **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 a format of any one type of case study. - Search the latest information on various types of case studies using internet/books/magazines. - Gather data focusing advantages, disadvantages and applications of various types of case studies. - Prepare a specimen format of any one type of case studies under Packaging filed. - Prepare a report on above.		06
2.	Carry out Problem Analysis for a given problem in Packaging Technology. - Search the literature on given situation using internet/books/magazines. - Collect information/data. - Analyze the data in reaching substantiated conclusions using analytical tools. - Prepare a report on above.		06
3.	Carry out a survey on Professional Etiquette - Visit a nearby Packaging or Packaging user Industry. - Collect information on how to behave & codes being followed there and advantages of the same. - Prepare a report.		10
4.	Prepare a Specimen Technical Report. - Select by research any three different national or international technical research journals. - Study the standard formats of Technical Report/Research papers of the selected journals. - Prepare a Specimen Technical Report of your choice on the basis of the guidelines given.		06
5.	Prepare a report on Role of Engineers in Society. - Collect and study the literature from at least three online or offline references of repute. - Create a questionnaire & Interview the engineers devoted to the society. - Prepare a report.		10
6.	Carry out a case study on recycling of packaging waste. - Visit a nearby scrap merchant; gather information on plastic identification and segregation techniques, work flow, capacity, rate, etc. - Prepare a report.		06

7.	Carry out a case study on Primary, Secondary and Tertiary Packaging of Pharmaceutical Products. • Visit nearby Medical Stores for Primary & Secondary Packaging. • Visit a nearby drug wholesaler for tertiary packaging. • Observe & collect the information on - packaging materials, style or types of packaging used, types of tamper proofing provided with various kinds of products. • Prepare a report. OR Carry out a case study on Primary, Secondary and Tertiary Packaging of Food Products. • Visit nearby Departmental Stores for Primary & Secondary Packaging. • Visit a nearby Drug wholesaler for tertiary packaging. • Observe & collect the information on - packaging materials, style or types of packaging used, types of tamper proofing provided with various kinds of products. Prepare a report.		08
8.	Carry out a case study on Distribution channel for a FMCG product. ❖ Search the data from various online and offline sources. ❖ Select a famous brand in FMCG. ❖ Visit a nearby FMCG stockiest. ❖ Gather information on the topic by observation and question answers. ❖ Prepare a report. OR Carry out a case study on Identification of Printing Processes used on Package Printing. • Select the printed product. • Search the information on printing techniques used for it. • Visit a nearby printing industry which has the similar printing process. • Observe the process, inputs - especially substrates, question the staff for detailed information. ❖ Prepare a report.		10
Skill Assessment			02
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	--	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	Procedure	10
2	Performance / skill	20
3	Writing Report	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	3	-
4	-	3	3	-	-	-	-	3	3	3	3	-
5	-	3	3	-	3	-	-	3	3	3	3	-
6	-	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.	Fundamentals Of Packaging	F.A. Paine , The Institute of Packaging; Revised Ed edition, 1981.	978-0950756707 0950756709
2.	Packaging users Handbook	F.A. Paine , Springer, 1991.	9780751401516 978-1-4613-1483-7
3.	The Wiley Encyclopedia of Packaging Technology.	Marilyn Bakker, John Wiley & Sons Inc. Canada	0471-80940-3
4.	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, 2E, PHI LPL, 2014.	978-81-203-5054-0

❖ **E-REFERENCES:**

- <https://www.prepressure.com/printing/processes> assessed on 05th January 2017.
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- <https://en.wikipedia.org/wiki/Engineer> 19th January 2017.
- <http://www.wikihow.com/Behave-at-Work> 25th January 2017.
- <http://www.news.com.au/finance/work/essential-office-etiquette-tips/news-story/7c70505aa840a8119944e5b0147f0b7e> 25th January 2017.
- <http://www.packplussouth.in/conPres2011/Shekar%20das-aurobindo.pdf> 30th January 2017.
- <http://www.ipapharma.org/events/stability/jbhat.pdf> 30th January 2017.

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

- Computer lab with internet facility.
- Text Editing Software like MS Word.
- Basic function statistical software like MS Excel.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: PROFESSIONAL COURSES (PROJECT COURSES)
COURSE CODE	: PK413E ^{\$}
COURSE TITLE	: INDUSTRIAL PROJECT
PREREQUISITE	: 100 Credits
TEACHING SCHEME	: TH:00; TU:00;PR: 04(CLOCK Hrs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: NIL
PR. TEE EXAM	: 02 HRs (External)
PT. EXAM	: 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:

Practicals	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 - Prepare working models of packaging processes and machineries. - Prepare working model of package conversion machine. - Prepare working model of testing equipment. - Develop present packages for betterment through value addition. - Perform comparative analysis of two or more different packages for similar product, and suggest value addition. - Costing calculations of packages, economics of packaging cost. - Analyse Environmental burdens imposed due to packaging activities. - Analyse statistical data for improvement in packages. - Analyse data for package development through study of damages to product and packages. - Test packages on various grounds to make them more appropriate. - Design packages. Perform Literature Survey - Refer various Periodicals, Journals, Books, Internet literature related to project topic - Note down the findings. - Prepare database of collected literature on the basis of title, area of work, methodology used & type of work. - Recognize industrial need.	Introductory Task and Literature Survey	06
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 software for preparing synopsis. - Submit the Synopsis to the guide. - Get synopsis approved from guide. - Prepare action plan of project activities - Submit the action plan to guide. - Get action plan approved from guide.	Planning	10

3	Perform Project work: List of activities to be performed to carry out project task : Package Testing, Manufacturing, Data collection, Analysing data, Designing, Comparison, Brain storming, Discussions, idea sharing, Valuation, Prototype designing and manufacturing, Cost analysis, Industry visit, etc.	Project Work	14
4	Test the working of Project.	Testing	14
5	Prepare project report in standard format, which includes following: • Title Page (which includes): Project Title, Purpose of submission, Institute logo, Students Name, Guide Name, Department and Institute Name. • Certificates: Student declaration, Certificate from guide. • Acknowledgement. • Table of contents. • List of Tables. • List of Figures. • List of abbreviations and acronyms (if any). • Text. 1. Introduction, objectives. 2. Literature Survey. 3. Methodology/Materials/Methods/Estimate. 4. Results. 5. Summary/Conclusion. 6. References. Use Latex software for preparing report. Perform plagiarism check from free internet site if required. • Submit report of plagiarism check to the guide with project report	Project Writing	14
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 & Project work done	1, 2, 3, 4,5,6
		Writing		Continuous	10	--	Project Report	1, 2, 3, 4,5,6
				TOTAL	50	20		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	100	40	Rubrics & Project Report and work done	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End Of Course			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of topic	10
2	Literature survey	10
3	Project planning and implementation	10
4	Work done, Feasibility of work, Results	50
5	Report writing	10
6	Presentation of work and viva voce	10
Total		100

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

Course Outcomes (COs)	Program Outcomes (POs)										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
1	–	3	–	–	3	3	–	3	–	–	3	3
2	–	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	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.	Fundamentals of Packaging	F.A. Paine , The Institute of Packaging; Revised edition, 1981.	978-0950756707 0950756709
2.	Packaging users Handbook	F.A. Paine , Springer, 1991.	9780751401516 978-1-4613-1483-7
3.	The Wiley Encyclopedia of Packaging Technology.	Marilyn Bakker, John Wiley & Sons Inc. Canada	0471-80940-3
4	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, 2E, PHI LPL, 2014.	978-81-203-5054-0
5	Packaging Machinery Operations Series	C. Glen Davis, PMMI, USA, 1991.	--
6	Engineering Design Handbook - Packaging and Pack Engineering	John Wiley & Sons	978-1-61583-998-8

7	Fundamentals of Packaging Technology	Walter Soroka, Institute of Packaging Professionals, Fourth E, 2009	1930268289 9781930268289
8	Package Design Engineering	Kenneth Brown, John Willey & Sons, Inc Publishers, New York, 1959	-

❖ **E-REFERENCES:**

- www.convertpdfsnow.com/Free/Download, assessed on 03rd January, 2017.
- www.easydocmerge.com/Download, assessed on 07th January, 2017.

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

- Bursting strength tester.
- Box compression tester.
- Drop tester.
- Vibration tester.
- Universal testing machine.
- GSM indicator/ weighing scale.
- Crush tester
- Puncture Tester.
- Dart Impact tester.
- Thickness caliper.
- Cobb tester.

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr.A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. Imran K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Retired Head of Department.	Head of Department, Packaging Technology, Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Retired Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6	Mr.M.S. Deshpande	Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7	Mr. Suresh Thakur	Managing Director.	Palekar Food Products, MIDC, Amravati.

8	Dr. S.W.Rajurkar	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
9	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

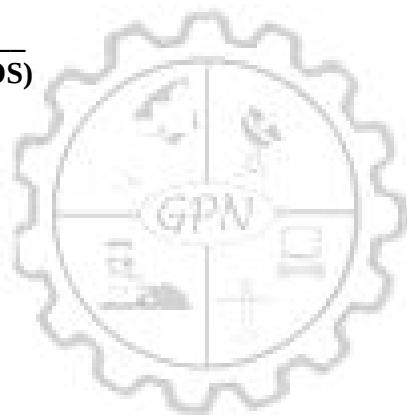
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 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)



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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

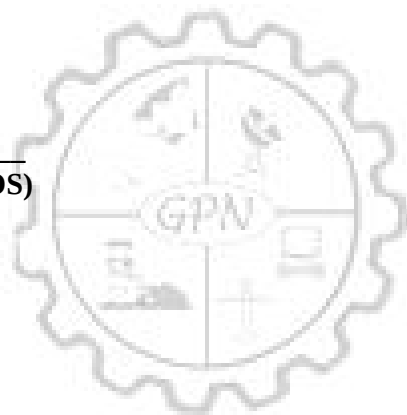
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

- 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: PK501E^s
COURSE TITLE	: PACKAGING OF FOOD & BEVERAGES
PREREQUISITE	: 50 CREDITS
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. EXAM	: 01 HR.

❖ **RATIONALE:**

Food is one of the most important biological needs for existence. Preservation of food for longer duration of time has been a continual effort which has given birth to Food Science. Proper Packaging is the key player in enhancing the shelf life of the food products & beverages. While working in any Food & Beverage Industry a Packaging Technician must have the basic knowledge of various types of foods, causes of deterioration & spoilage of food, shelf life enhancement, preservation techniques, packaging practices and modern developments in the field of packaging of food products & beverage, hence the course.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to;

1. Identify food products and beverages.
2. Identify causes of food deterioration and advise appropriate methods for food preservation.
3. Select suitable material and method of packaging for food products and beverages.
4. Perform various tests in Shelf Life Study.
5. Use different machines/equipments for different work.
6. Perform basic food preservation and sensory evaluation work.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Classification of Foods & Beverages	1. Classify Indian food & beverage market in perspective of Packaging. 2. Classify different types of foods and beverages. 3. Define the various terminologies of food & beverages. 4. Describe various types of foods and beverages. 5. Identify various types of foods & beverages.	1.1 Food: Importance for life, Essential nutrients, Functions of food, Indian food market; a scenario. 1.2 Classification of foods, Terminologies - perishable, non perishable foods and shelf stable, fresh food, fresh produce, canned foods, frozen foods, dried foods, grain products, snacks, jams & jellies. 1.3 Introduction to main food types: Raw red meat, Raw poultry, Cooked, cured and processed meat products, Fish and fish products, Fruits and vegetables, Dairy products, Fats & oils, Fresh Herbs & Spices, Nuts & Seeds. 1.4 Beverages: Indian beverage market, types of beverages.	06
2. Food Biodeterioration and Methods of Preservation	1. Define various terminologies in food biodeterioration and preservation 2. Draw graphs for Effect of moisture on various kinds of foods. 3. Describe different types & causes of biodeterioration, its prevention. 4. Describe food spoilage, preservation methods and modern trends. 5. Compare the different Food preservation methods. 6. Choose suitable preservation method. 7. Identify deterioration, spoilage in foods.	2.1 Biodeterioration - Introduction. Agents of food biodeterioration; Enzymes - Microorganisms (Bacteria, Fungi), Microbial growth - binary fission, Requirements for growth - physical, chemical and energy, effect of temperature on microbial growth. Non-enzymic biodeterioration, Prevention of microbial growth in food. 2.2 Role of water in foods, moisture content & water activity, sorption isotherm. 2.3 Food Spoilage; difference between bio-deterioration and food spoilage, food poisoning, Biological and Abiotic	14

		spoilage - causes and difference. 2.4 Food preservation methods: High temperature - Blanching, Thermal processing/retorting, Continuous thermal processing (aseptic), Pasteurization. Low temperature; Freezing - effects of freezing, Chilling and cooling. • Drying and water activity control. • Chemical preservation - Curing, Pickling, Smoking. Fermentation, modifying the atmosphere. 2.5 Other techniques and developments: High pressure processing, Ohmic heating, Irradiation, Membrane processing, Microwave processing.	
3. Packaged Product Quality and Shelf Life	1. Define various terminologies in Shelf life studies. 2. Describe the various factors affecting shelf life of packaged foods. 3. Draw indices/diagrams in shelf life analysis. 4. Identify suitable sensory evaluation techniques. 5. Analyze data of sensory evaluation. 6. Describe methods in shelf life studies. 7. Compare procedures in shelf life studies. 8. Analyze related packages.	3.1 Definition of Shelf Life, Factors affecting shelf life of packaged foods. 3.2 Food factors affecting Shelf Life; Food deterioration Modes, Package dependent versus product dependent deteriorations, Quality indexes and critical limits, sensory quality, microbial count, losses in nutrients and pigments, production of undesirable components, physical changes and processes. 3.3 Environmental factors affecting Shelf Life - Ambient environment, physical environment and human environment. 3.4 Package factors affecting Shelf Life - Packaging parameters important to shelf life, permeation versus reaction controlled shelf life, Migration, Package interactions. 3.5 Shelf Life Studies - Testing under Normal conditions,	10

		testing under accelerated conditions, procedure for shelf life studies.	
4. Food Products Stability and Packaging Requirements	1. Define terminologies related to the stability of various kinds of food products and beverages. 2. List & describe the packaging requirements for various kinds of food products and beverages. 3. Describe Packaging practices & modern trends. 4. Describe various kinds of food products and beverages. 5. Identify related foods. 6. Choose the suitable packaging material. 9. Analyze related packages.	4.1 Cereal and bakery Products - Cereal Grain and Flours, Ready to eat breakfast cereals and snacks, fresh and dried pasta products, fresh bakery products. Packaging requirements, practices & modern trends. 4.2 Meat and fish products - Fresh meat and poultry, processed meat products, fish products. Packaging requirements, practices & modern trends. 4.3 Dairy products; Pasteurized and UHT sterilized milk and cream, Dried milk products, cheese, fermented milk. Packaging requirements, practices & modern trends. 4.4 Confectionary products - chocolate products, hard boiled sweets, toffees and other confectioneries. Packaging requirements, practices & modern trends. 4.5 Fat and oils - Packaging requirements, practices & modern trends. 4.6 Beverages/Drinks - Fruit juices, soft drinks, beer, wine. Packaging requirements, practices & modern trends, Tetrapack - concept, layers functions of each layer & its market. 4.7 Fresh fruit and vegetables - Packaging requirements, practices & modern trends 4.8 Frozen foods - Packaging requirements, practices & modern trends.	12
5. Modified Atmosphere Packaging	1. Define the various terms in MAP process/system. 2. Describe the effect of gaseous environments on various factors. 3. Select suitable plastic	5.1 Modified atmosphere packaging (MAP) - Introduction, Gases used in MAP. 5.2 Effect of the gaseous environment on the activity of	10

	packaging materials for MAP. 4. Compare Chamber m/c with Snorkel machines used in MAP. 5. Identify products and packages. 6. Analyze MAP.	bacteria, yeasts and moulds, Effect of oxygen, Effect of carbon dioxide, Effect of nitrogen. 5.3 Effect of the gaseous environment on the chemical, biochemical and physical properties of foods; Effect of oxygen, Effects of other MAP gases. 5.4 Modification of the pack atmosphere - Gas flushing, compensated vacuum gas flushing. 5.5 Main plastics used in MAP - Names, Factors of selection of plastic packaging materials. 5.6 Main food types packed in MAP. 5.7 Modified atmosphere packaging machines- Chamber machines, Snorkel machines.	
6. Other Modern Methods of Food Packaging & Labeling	1. Define the various terms in Modern Methods of Food Packaging & Labeling. 2. List various materials used in Active, Intelligent, Smart, and Microwaveable Packaging. 3. Describe Active, Intelligent, Smart, Microwaveable Packaging systems. 4. Describe High Barrier plastic packaging - Stepcan, Letpak. 5. Design label for primary package. 6. Describe labeling and legislative requirements for it. 7. Compare Active, Intelligent and Smart Packaging Systems. 8. Choose suitable packaging system.	6.1 Active Packaging - Introduction, Oxygen scavengers, oxygen scavenging materials, Carbon dioxide scavengers/emitters, Ethylene scavengers, Ethanol emitters, Preservative releasers, Moisture absorbers, Flavor/odor absorbers, Temperature control packaging, Food safety, consumer acceptability and regulatory requirements. 6.2 Intelligent Packaging - Introduction, framework. 6.3 Smart Packaging - Introduction, Smart Packaging Devices - TTI, Leak, Gas Indicators, Freshness Indicator, Barcode, Electronic Identification Tags. 6.4 Microwaveable Packaging - Microwaves and Microwave oven, Microwave/food/packaging interaction, List of challenges in microwave heating of foods. 6.5 Microwavable packaging	12

		materials - microwave transparent materials, microwave reflective materials, microwave absorbent material. 6.6 Interactive microwave packages - surface heating packages, field modification packages, and steam cooking packages. 6.7 High Barrier plastic packaging - Stepcan, Letpak. 6.8 Labeling - Introduction, types, labeling Information, legislative labeling requirements.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify different types of Food Products and Beverages. - Visit nearby market. - List and classify the products. - Prepare a report.	Classification of Foods & Beverages	4
2	Search present market status/ scenario of Indian Food and Beverage market. - Use tools like Internet and magazines etc. - Prepare a report on it.		2
3	Perform freezing of various food products and observe & analyze the effects of freezing on various food products. - Prepare a report. OR Identify the agents of biodeterioration in Perished Foods. - Collect sample - Observe & identify the causes of spoilage. - Prepare a report.		4
4	Find out water content in food products like bread, papad, etc. - Collect samples. - Perform the test and prepare a report. OR Perform chemical preservation i.e. Pickling, Smoking or Curing for a suitable food product.		4
5	Perform Simulated Sensory Evaluation / Organoleptic Properties of any food product. Form groups of 04 students each.	Packaged Product Quality and	4

	- Identify/collect samples. - Perform the evaluation. - Note the readings. - Prepare a report. OR Perform Shelf Life study - Testing Under Normal Conditions.	Shelf Life	
6	Find out GTR of a Primary Package of any Food product. OR Find out WVTR of a Primary Package of any Food product.		2
7	Identify packaging materials and packaging systems used - for Cereal and bakery Products, Meat and fish products, Dairy products and Confectionary. OR Identify packaging materials and packaging techniques employed for the packaging of fat, oil and beverages. - Visit nearby market. - Observe packaged products. - Note the related observations. - Prepare a report.	Food Products Stability and Packaging Requirements	4
8	Carry out a case study on MAP for chips or similar food products. - Use tools like Internet and magazines etc. - Prepare a report on it.	Modified Atmosphere Packaging	4
9	Perform Bar Code Reading. OR Design a Label for a bottle of Mineral Water or Beverage on Desktop Computer System. - Identify product. - Prepare a layout on paper. - Design on computer. - Take printout.	Other Modern Methods of Food Packaging & Labeling	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	
1	Classification of Foods & Beverages	08(02)	00(00)	00(00)	08(02)
2	Food Biodeterioration and Methods of Preservation	00(04)	10(04)	06(00)	16(08)
3	Packaged Product Quality and Shelf Life	02(00)	04(08)	06(00)	12(08)
4	Food Products Stability and Packaging Requirements	02(00)	12(00)	00(04)	14(04)
5	Modified Atmosphere Packaging	02(00)	08(06)	00(04)	10(10)
6	Modern Methods of Food Packaging & Labeling	00(02)	04(06)	06(00)	10(08)
	Total	14(08)	38(24)	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	3	R	2	4	R	2	5	R	2	6	R	2	5/7
	1	R	2																
02	1	R	4	2	U	4	3	U	4	3	U	4	3	U	4				3/5
03	4	U	4	4	U	4	4	U	4	2	R	4	2	U	4				3/5
04	5	U	4	5	U	4	6	U	4	4	A	4	5	A	4				3/5
05	2	U	6	2	A	6	6	U	6										2/3
06	3	A	6	6	A	6	5	U	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Procedure/sketches/workflow chart.	10
2	Performance/ skill.	20
3	Result/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	2	2	-	-	1	2	2	3	3	2
5	-	3	2	2	-	-	-	2	2	3	3	2
6	-	3	2	2	-	-	1	2	2	3	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Food Packaging Science and Technology	Lee, Yam and Luciano, CRC Press, 1E, 2008.	13: 978-0-8247-2779-6
2.	Food Packaging Technology	Richard, Derek and Mark, Blackwell Publishing, 1E, 2003.	0-8493-9788-X
4.	Food Packaging Principle and Practice	G. Robertson, CRC Press, 3E, 2012.	978-1-4398-6241-4
5.	Food Packaging Materials	M. Mahadeviah, R. Gowramma, McGraw Hill India Pvt. Ltd., 1998.	978-0074622384
6.	Food Packaging and Preservation	M. Mathlouthi, Aspen Publishers Inc., 1999.	978-0-8342-1349-4
7.	Modified Atmosphere Packaging of Food	Ooraikul, Springer pub, 1991.	978-1-4615-2117-4
8.	Food Packaging Materials	Crosby, N. T., Elsevier Applied Science, 1981.	978-0-8533-4926-6

❖ **E-REFERENCES:**

- https://en.wikipedia.org/wiki/Food_group, assessed on 01st July, 2016
- <http://www.slideshare.net/Adrienna/make-india-food-processing-feb-2016>, assessed on 01st July, 2016
- <http://www.slideshare.net/VictoriaHansen/year-9-10-first-principles-of-food-preparation-cooking-causes-of-food-deterioration-spoilage>, assessed on 3rd July, 2016
- https://en.wikipedia.org/wiki/Moisture_sorption_isotherm, assessed on 05th July, 2016
- https://en.wikipedia.org/wiki/Food_preservation, assessed on 06th July, 2016
- <http://www.slideshare.net/rmasterson/food-and-microbes>, assessed on 01st July, 2016
- <http://www.slideshare.net/SarbojeetJana/food-packaging-technology-12866112>, assessed on 7th July, 2016
- <http://www.slideshare.net/hoannguyencong790/food-freezing>, assessed on 09th July, 2016
- <http://slideplayer.com/slide/8974013/>, assessed on 10th July, 2016
- <http://www.slideshare.net/abcresearchlaboratories/how-to-test-the-shelf-life-of-your-food-p>, assessed on 11th July, 2016
- https://en.wikipedia.org/wiki/Shelf_life, assessed on 15th July, 2016
- http://wikieducator.org/Food_Packaging_Technology, assessed on 16th July, 2016
- <http://www.modifiedatmospherepackaging.com/>, assessed on 17th July, 2016
- <http://www.slideshare.net/aulger/modified-atmosphere-and-intelligent-packaging-of-food-presentation>, assessed on 19th July, 2016

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

1. Desktop computers.
2. General purpose refrigerator.
3. Biology lab microscope.
4. Microwave oven/toast maker.
5. GTR testing machine.
6. WVTR testing machine.
7. Bar coding System.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.

5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: PK502E^S
COURSE TITLE	: REFRIGERATION IN PACKAGING
PREREQUISITE	: 50 CREDITS
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. EXAM	: 01 HR.

❖ RATIONALE:

Food packaging has become a critical issue in our country. However, preservation of food in times of abundance, for year round availability calls for proper processing and preservation technologies. Cold storages for bulk commodities is the need of the hour.

Refrigeration process is instrumental in working of cold storage. Detailed knowledge of different refrigerants, their properties, refrigeration techniques, operating parameters is very vital to adopt this technology of preservations. Similarly, most of the packaging industries use conditioned air for product manufacturing, product processing and while carrying packaging functions. Thus, knowledge of thermodynamics principles, basic heat transfer calculations is also needed for a technician practicing in the area. The course has been introduced with above concepts in mind.

❖ COURSE OUTCOMES:

After completing this course students will be able to –

1. Identify and specify given refrigeration equipment.
2. Suggest suitable cold storage for a specific product of needed capacity.
3. Identify various components of a refrigeration system and their functions.
4. Carry out general troubleshooting in a refrigeration and air conditioning system & observe safety measures.
5. Detect leakage of refrigerant using appropriate technique and charge the system with suitable refrigerant.
6. Use refrigeration system and air conditioner test rigs.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Basic Thermodynamics	1. Define related terms. 2. Describe various states & properties of a system. 3. Distinguish between work, energy, mechanical work & thermodynamic work. 4. State units of various entities. 5. Describe various types of energies. 6. State various gas equations & laws governing the behavior of gases. 7. Represent various thermodynamic processes on p-v & T-s planes. 8. State various laws of thermodynamics. 9. Calculate various properties of gases. 10. Classify energy.	1.1 Thermodynamic system, surrounding & universe – definitions and examples. 1.2 Properties of a system – extensive & intensive properties. 1.3 State of a system. 1.4 Heat, specific heat, latent heat, sensible heat – definitions & their units. 1.5 Work & thermodynamic work – definitions & units. 1.6 Energy- definition, types & units. 1.7 Perfect gas- definition & examples, specific heats of a gas, general gas equation, characteristic gas equation. 1.8 Laws of perfect gas – Boyle's law, Charle's law, Gay-Lussac law. 1.9 Definitions of enthalpy & entropy. 1.10 Representation of following thermodynamic processes on p-v & T-s planes – constant volume, constant pressure, and constant temperature, isentropic. 1.11 Thermodynamic cycle – definition & its types. 1.12 Laws of thermodynamics – Zeroth law, First law & Second law. 1.13 Simple numerical. 1.14 Related equipments.	08
2. Refrigerants	1. Define related terms. 2. Classify refrigerants with examples. 3. Identify characteristics of a refrigerant. 4. Identify leakage of	2.1 Refrigerants – Definition, desirable properties, classification, examples. 2.2 Primary, secondary, halo-carbon, Azeotrope, inorganic and hydro-carbon refrigerants –	06

	refrigerant from a system. 5. State various properties of a refrigerant. 6. Identify & designate given refrigerant.	examples of commonly used refrigerants, general characteristics, leakage detection. 2.3 General thermodynamic, physical & chemical properties desirable in a refrigerant. 2.4 Designation system of refrigerants.	
3. Air Refrigeration	1. Define related terms. 2. State necessity & applications of air refrigeration. 3. Compare a pump, engine with a refrigerator. 4. Describe unit of refrigeration, COP, Refrigerating effect, etc. 5. State various methods of refrigeration. 6. Describe various air refrigeration cycles. 7. Describe air refrigeration system of an aircraft.	3.1 Refrigeration – definition, necessity, applications. 3.2 Heat pump, heat engine, refrigerator- Definition, purpose, comparison, uses & applications. 3.3 Unit of refrigeration, COP of refrigerator, refrigerating effect – definition & unit. 3.4 Methods of refrigeration. 3.5 Air refrigeration cycles – open, closed, reversed Carnot, Bell-Coleman. 3.6 Air refrigeration system – limited to simple air cooling system. (No numerical)	06
4. Vapour Refrigeration System	1. Define related terms. 2. State the principle of vapour refrigeration. 3. Identify various process of cycle. 4. Describe various types of theoretical cycles and an actual cycle. 5. Distinguish between theoretical and actual cycle. 6. Describe various components, working, with their functions. 7. Describe a simple vapour refrigeration system. 8. State the need, advantages and types of compound systems. 9. Describe absorption system. 10. State advantages and disadvantages of various	4.1 Vapour compression cycle – principle, working, different processes. 4.2 Types of theoretical vapour compression cycles. 4.3 Actual vapour compression cycle - description. 4.4 Differences between actual & theoretical cycles. 4.5 Simple vapour compression refrigeration system – advantages & disadvantages over air refrigeration, main components, their functions, working. (No numerical) 4.6 Compound vapour compression system – need, advantages, list their types. 4.7 Vapour absorption refrigeration system – Simple vapour absorption system – major components & working.	10

	systems.	• Practical vapour compression system components & working. • Advantages & disadvantages of vapour absorption system.	
5. Air Conditioners	1. Define related terms. 2. State main parts of an air conditioner with their functions. 3. Classify air conditioning systems. 4. Describe various air conditioners for their construction & working. 5. Draw schematic of air conditioners. 6. State advantages & limitations of various air conditioning systems. 7. Identify an air conditioning system along with its components.	5.1 Air conditioning – definition, factors controlled in air conditioning. 5.2 Air conditioning system – definition, main parts & their function, classification & their definitions. 5.3 Summer air conditioner, winter air conditioner, Year round air conditioning system - schematic arrangement & working. 5.4 Split air conditioner – main parts & working. 5.5 Unitary air conditioning system – types & description. 5.6 Central air conditioning system – uses, advantages, description.	10
6. Cold Storages	1. Define related terms. 2. State the purpose and applications of cold storages. 3. Classify cold storages. 4. Describe various cold storages with regards to their construction, physical structure, instrumentation required. 5. Describe construction of refrigerated trucks & marine air conditioning. 6. Describe the method of cooling adapted in various cold storages. 7. State applications of given cold storage.	6.1 Cold storages – Purpose & applications in packaging. 6.2 Types – domestic refrigerator, commercial refrigerator & its types, cold storages & frozen storages - physical structures, controlled parameters, instrumentation & other facilities. 6.3 Refrigerated trucks, marine air conditioning – description on construction & method of cooling adopted, applications.	08
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Determine relative humidity of the atmosphere using Dry bulb and Wet bulb thermometers and confirmation of the same using internet.	Basic Thermodynamics	02
2	Carry out charging in a refrigeration/ air conditioning system. • Detect leakage • Carry out repairs • Recharge the system • Carry out Test	Refrigerants	06
3	Use vapour compression refrigeration system. • Record readings of temperature, humidity, air flow velocity, etc • Carry out necessary mathematical analysis to determine the capacity, efficiency, etc. • Draw its schematic. • Write a report. OR Prepare a report on a Vapour absorption refrigeration system: • Visit an industry using vapour absorption system. • Observe refrigeration system. • Identify various parts of the system. • Sketch the parts, label them stating their functions.	Vapour Refrigeration System	04
4	Prepare a report on a Domestic refrigerator: • Observe a refrigerator. • Sketch it. • Identify various parts and understand their functions. • Describe various controls used in it.		04
5	Prepare a report on a refrigerated vehicle (Van): • Observe a refrigerated van. • Identify the type of refrigeration system mounted on it. • Identify various components of system.	Cold Storages	06
6	Prepare a report on the cold storage for milk/fruits/vegetables/food grains. OR Prepare a report on refrigerated cabinets in a retail stores : The report includes following: • Sketch the configuration. • List various products stored and the cost/rent		06

	incurred. • Identify various parts and their functions. • Arrangement of various parts in the system. • Various controls used.		
7	Use Air conditioning test rig. OR Assess various parameters within an air conditioned room.	Air Conditioners	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	Basic Thermodynamics	06(02)	04(00)	06(00)	16(02)
02	Refrigerants	06(00)	04(00)	00(04)	10(04)
03	Air Refrigeration	02(00)	06(00)	06(00)	14(00)
04	Vapour Refrigeration System	02(04)	00(12)	06(00)	08(16)
05	Air Conditioners	02(04)	12(06)	00(00)	14(10)
06	Cold Storages	04(02)	04(00)	00(06)	08(08)
	Total	22(12)	30(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	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	5/7
	1	R	2																
02	1	R	4	2	R	4	6	R	4	4	R	4	5	R	4				3/5
03	6	U	4	5	U	4	5	U	4	4	U	4	4	U	4				3/5
04	1	U	4	2	U	4	5	U	4	4	U	4	2	A	4				3/5
05	1	A	6	3	U	6	5	U	6										2/3
06	4	A	6	3	A	6	6	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Mark

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	20
2	Identification/ suggestions	10
3	Report writing.	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	2	3	3	2
5	-	3	2	2	2	1	-	2	2	3	3	2
6	-	3	2	2	2	-	-	2	2	3	3	2

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

❖ **REFERENCES & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Refrigeration and Air Conditioning	R.S.Khurmi, S.Chand and Co.,2001	81-219-1687-9
2.	Refrigeration and Air Conditioning	C. P. Arora, McGraw Hill Education; 3 E, 2017	10: 9351340163 13: 978-9351340164
3.	Refrigeration and Air Conditioning	Manohar Prasad, New Age Publications,2009	13: 788122414295
4.	Refrigeration and Air Conditioning	P.N.Ananthanarayanan; Tata McGraw Hill,4E, 2015	10: 1259062708 13: 9781259062704
5.	Principles of Refrigeration	Roy Dossat, Pearson Education, 5E, 2001	10: 0130272701 13: 978-0130272706
6.	Commercial Refrigeration	Edwin P. Anderson ; Taraporevala Sons & Co,1978	-

❖ **E-REFERENCES:**

- https://en.wikipedia.org/wiki/Relative_humidity, assessed on 22 September 2016.
- https://en.wikipedia.org/wiki/Air_conditioning, assessed on 23 September 2016.
- nptel.ac.in/courses/112105129/pdf/RAC%20Lecture%209.pdf, assessed on 25 September 2016.
- <https://www.youtube.com/watch?v=LI8Ku-mFQx>, assessed on 27 September 2016.
- <https://www.youtube.com/watch?v=gt1OVt1JWwI>, assessed on 27 September 2016.
- <https://www.youtube.com/watch?v=34K61ECbGD4>, assessed on 28 September 2016.
- <https://www.youtube.com/watch?v=r7qIL4bk66A>, assessed on 29 September 2016.
- <https://www.youtube.com/watch?v=Ghp-O1bMMuU>, assessed on 30 September 2016.
- <https://www.youtube.com/watch?v=QFmIqvlWBec>, assessed on 30 September 2016.
- <https://www.youtube.com/watch?v=dBgk74o6wwA>, assessed on 01 October 2016.
- <https://www.youtube.com/watch?v=AUvt-lJcGsM>, assessed on 03 October 2016.
- https://www.youtube.com/watch?v=SDxBC_naJ14, assessed on 05 October 2016.

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

1. Pressure gauge.
2. Temperature recording device/ thermometer.
3. Vapour compression refrigeration system.
4. Air conditioning test rig

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: PK503E^s
COURSE TITLE	: PACKAGING OF CHEMICALS
PREREQUISITE	: 50 CREDITS
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. EXAM	: 01 HR.

❖ RATIONALE:

Chemicals and dangerous goods are capable of causing damage to the surroundings if they come out of the package and are exposed to the triggering factors. This may lead to loss of property, lives and can result in irrecoverable damages to human, animal, environment, etc. This calls for special attention to its packaging.

Paints, cement, fertilizers, textiles are transported in bulk; hence require attention to related packaging considerations. Handicrafts are delicate one which needs special attention to its cushioning. The course content is compiled to familiarize the technician with packaging aspects, the laws & regulations encompassing above products.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Identify various packaging materials.
2. Recommend suitable packaging for different applications.
3. Apply knowledge of labeling laws and regulations.
4. Evaluate different packages.
5. Conduct various tests on packages.
6. Operate various testing machines.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Packaging of Chemicals and Dangerous Goods	1. Define the various terminologies in packaging of chemicals and dangerous good. 2. List the types and applications of returnable container. 3. Classify chemical. 4. State economics of returnable container and its packaging consideration. 5. Select the appropriate material and container for Packaging of Chemicals and Dangerous Goods. 6. Describe the basic packaging requirements and various laws & regulating authorities. 7. Draw the various symbols for chemical packages. 8. Compare returnable container with non-returnable container. 9. Identify main components & product characteristics.	1.1 General classification of chemicals, classification for packaging purpose-according to physical state and form. 1.2 Basic packaging requirements of packaging of chemicals-safety, security, customer convenience, cleanliness, shelf-life, cost, Appearance, reuse / alternative use value, availability. 1.3 Laws and regulations-national / international laws and regulations for coding, marking and labeling, transport and handling, regulating authorities 1.4 Materials and containers for chemicals for industrial use (bulk), Closing methods, safety and security features, selection criteria. 1.5 Applications and economics of returnable containers. 1.6 Current packaging practices for domestic and agricultural chemicals (unit packages).	10
2. Packaging of Paints	1. Define the various terminologies in packaging of paint. 2. List characteristics and applications. 3. Classify paints. 4. State the composition of paint. 5. Summarize market sector of paints. 6. Describe damages & protection, preservation methods paints. 7. Select the suitable containers for paints 8. Describe distribution channels	2.1 Classification of paints based on physical state, composition, application, specialties, etc. Methods of application of paints, basic constituents of paints, Major brands in Indian market and their product range, Local manufacturers and their brand names. 2.2 Major sectors of Paint market: industrial, commercial, urban, rural, consumer characteristics and market trends, Distribution channels and practices for	08

	and marketing of paint. 9. State laws and regulation & standards of paint packaging. 10. Identify current packaging practices & its functions. 11. Compare rigid, flexible, metallic and plastic container for paint. 10. Draw the various symbols for paint packages. 12. Evaluate package performance.	branded and local manufacturers, sales outlets, marketing methods. 2.3 Product characteristics in general based on the physical state and composition of the paints, Likely damages, protection and preservation needs. 2.4 Functional considerations • Unitization: basis and ranges for various types. • Containment: Basic rigid and flexible containers suitable for paints, closures, methods of closing, materials and comparison. • Communication: communication needs, advertising needs, components of communication • Dispensing and dispersing: relevant packaging features, need and suitability to various applications. • PP & TE: Importance, various features to ensure PP & TE, comparison of metallic and plastic containers. 2.5 Evaluation of packages, relevant standards, laws and regulations, current packaging trends.	
3. Packaging of Cement	1. Define the various terminologies in packaging of cement. 2. State applications of cement, types & composition. 3. List major brands, & product characteristics. 4. Describe damages, protection & preservation methods for cement. 5. Describe manufacturing process of cement. 6. Describe distribution channels, practices and marketing.	3.1 Standard types, typical composition, Schematic manufacturing process and application, Major brands in Indian market and their product range. 3.2 Major sectors of cement market: industrial, civil and structural engineering, individual, consumer characteristics and market trends, Distribution channels and practices, sales outlets, marketing methods. 3.3 Product characteristics:	08

	7. State laws and regulation & standards for packaging of cements. 8. Describe current packaging practices and functions. 9. Describe economic considerations of package. 10. Select standard method of handling, warehousing, loading & unloading. 11. Compare current packaging with conventional packaging. 12. Draw the various symbols for packages. 13. Identify main components & product characteristics. 14. Evaluate package performance.	physical and physiochemical, Likely damages and loss of product, protection and preservation needs. 3.4 Functional considerations: considerations for unitization, containment, protection, communication, PP & TE, Dispensing and package filling. 3.5 Transport handling and storage systems: Need for standard systems, current practices. 3.6 Economic considerations: cost of package and loss of product, cost of loss prevention, value of loss of product. 3.7 Global packaging trends, evaluation of packages, relevant standards.	
4. Packaging of Fertilizers	1. Define the various terminologies in packaging of fertilizers. 2. State applications of fertilizer, types & composition. 3. List major brands, & product characteristics. 4. Describe damages, protection & preservation methods for fertilizer. 5. Describe manufacturing process of fertilizer. 6. Describe distribution channels, practices and marketing. 7. State laws and regulation & standards for packaging of fertilizer. 8. Describe current packaging practices and functions. 9. Describe economic considerations of package. 10. Select standard method of handling, warehousing, loading & unloading. 11. Compare current packaging	4.1 Standard types, typical composition, Schematic manufacturing process, application, Major brands in Indian market and their product range. 4.2 Consumer characteristics and market trends, Distribution channels and practices, sales outlets, marketing methods. 4.3 Product characteristics: physical and physiochemical, Likely damages and loss of product, protection and preservation needs. 4.4 Functional considerations: considerations for unitization, containment, protection, communication, PP & TE, Dispensing and package filling. 4.5 Transport handling and storage systems: Need for standard systems, current practices.	08

	with conventional packaging. 12. Draw the various symbols for packages. 13. Identify main components & product characteristics. 14. Evaluate package performance.	4.6 Economic considerations: cost of package and loss of product, cost of loss prevention, value of loss of product. 4.7 Global packaging trends, evaluation of packages, relevant standards, export considerations	
5. Packaging of Garments and Accessories	1. Define the various terminologies in packaging of garments and accessories. 2. Classify the garments & customer. 3. State the major brands. 4. State characteristics of consumer and garments. 5. Describe the distribution channels and practices, marketing. 6. Identify current packaging practices and functions. 7. Select the appropriate materials & container for packaging. 8. Compare different options of packaging. 9. Describe economics considerations of packaging. 10. Evaluate package performance. 11. Draw the various symbols for packages. 12. Identify main components & product characteristics.	5.1 Range of products and detailed classification, Classification of customers of garments and their characteristics, general characteristics of garments as products: based on purpose or intended use, choice, colour, pattern, fashion, life, trend, occasion, age group, location, ethnic values, etc. 5.2 Major brands in garments trade, the range of products and the overview of their market share, local brands / unbranded products and their share in the market, Distribution practices, Characteristics of retail outlets and departmental stores. 5.3 Concept of window shopping, impulse buying, Display value and sales appeal as applied to garments, unique sales propositions. 5.4 General product characteristics, likely damages and protection needs. 5.5 Functional considerations like unitization, containment, protection and preservation, communication, Tamper evidence etc. 5.6 Various packaging practices, containers and closures, materials used	08

		currently.	
6. Packaging of Handicrafts and Fragile Articles	1. Define the various terminologies in packaging of handicrafts and fragile articles. 2. State the major brands, characteristics of consumer and garments. 3. List the famous areas of manufacturing handicrafts. 4. Classify the handcraft and fragile articles. 5. Select the appropriate materials & container for packaging. 6. Describe the marketing method, product characteristics, various functional considerations, protections, current packaging practices and functions, methods of cushioning & material of cushioning, economics considerations. 7. Select the appropriate materials & container for packaging. 8. Compare different options of packaging. 9. Draw the various symbols for packages. 10. Select the standard method of handling, warehousing, loading & unloading. 11. Identify main components & product characteristics.	6.1 Handicrafts - • Popular categories of handicrafts, handicraft trade, famous areas for making handicrafts in India, valuation of handicrafts. • Market of handicrafts in India, Customer characteristics, modern marketing methods for handicrafts like catalogue marketing. • Characteristics of handicrafts: uniqueness, multiples, replicas, originals, materials, skills, ethnicity and culture, etc, Materials of manufacture, general packaging characteristics of handicrafts as products, likely damages and protection needs. • Functional considerations for packaging of handicrafts. • Packaging of handicrafts for domestic and exports market, packaging materials. • Economic considerations of packaging against the product value. 6.2 Fragile Articles - • Definition and concept of fragility, examples of fragile articles. • Methods of avoiding shock damages to fragile goods. • Methods and Materials used for cushioning. • Functions of fitments in packaging of fragile goods. • Transport, handling and storage considerations	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Carry out a case study on packaging systems utilized for their products at any one of the following industry. 1. Chemical and Dangerous good Industry. 2. Paint Industry. 3. Garment Industry 4. Handcraft and fragile goods Industry. • Identify and visit an industry. • Observe the packaging systems/material. • Prepare a report.	All	08
2	Carry out evaluation of Chemical or Dangerous good Package. • Collect the samples. • Identify packaging system/material/, method of closing/dispensing, cushioning measures and tamper evidence. • Prepare a report.	Packaging of Chemicals and Dangerous Goods	04
3	Carry out evaluation of a garment package. • Collect sample for evaluation. • Perform evaluation for – Weighing the package, Identify the package/material, puncture test, bursting strength, compression, gsm, Cobb test and tensile test. • Note readings. • Prepare a report.	Packaging of Garments and Accessories	04
4	Carry out evaluation of any one handcrafted fragile goods package. • Collect a sample for evaluation. • Perform evaluation for – Weighing the package, Identify the package/material, drop test, vibration test, gsm/bursting strength/tensile test/box compression. • Note readings. • Prepare a report. OR Carry out evaluation for a paint package. • Collect a sample for evaluation. • Perform evaluation for – Weighing the package, Identify the package/material, drop test, vibration test, / compression test. • Note readings. • Prepare a report.	Packaging of Paints Packaging of Handicrafts and Fragile Articles	08

5	Carry out evaluation of a Cement or fertilizer package. • Collect sample for evaluation. • Perform evaluation for – Weighing the package, Identify the package/material, drop test, vibration test, Impact test, gsm and tensile test. • Note readings. • Prepare a report.	Packaging of Cement	06
Skill Assessment			02
Total Hrs.			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Packaging of Chemicals and Dangerous Goods	04(04)	04(04)	06(00)	14(08)
02	Packaging of Paints	04(00)	08(00)	00(06)	12(06)
03	Packaging of Cement	02(00)	04(00)	06(06)	12(06)
04	Packaging of Fertilizers	00(04)	06(04)	04(00)	10(08)
05	Packaging of Garments and Accessories	02(02)	08(04)	00(00)	10(06)
06	Packaging of Handicrafts and Fragile Articles	04(02)	08(04)	00(00)	12(06)
	Total	16(12)	38(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	
1	1	R	2	1	R	2	3	R	2	5	R	2	2	U	2	5	R	2	
	6	R	2																5/7
2	2	R	4	6	R	4	3	U	4	4	R	4	4	U	4				3/5
3	1	U	4	6	U	4	6	U	4	1	R	4	6	U	4				3/5
4	5	U	4	5	U	4	4	A	4	1	U	4	5	U	4				3/5
5	1	A	6	2	U	6	2	A	6										2/3
6	4	U	6	3	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, selection of equipment's, writing procedure etc.	10
2	Performance	20
3	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	-
2	-	3	-	-	-	-	3	-	-	3	3	-
3	-	3	-	-	-	-	3	-	-	3	3	-
4	-	3	2	2	-	-	3	2	2	3	3	2
5	-	3	2	2	-	-	-	2	2	3	3	2
6	-	3	2	2	-	-	-	2	2	3	3	2

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

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1	Handbook of Package Engineering	Joseph F. Hanlon, Robert j. Kelsey, Hallie e. Forcinio, CRC Press, Third Edition, 1998	10 : 1566763061 13 : 9781566763066
2	Fundamentals of Packaging Technology	Natarajan S./Govindarajan M./Kumar B., Phi Learning Pvt. Ltd, Second Edition, 2011	13: 9788120350540 10: 8120350545
3	Fundamentals Of Packaging	F.A. Paine , The Institute of Packaging; Revised Ed edition, 1981.	978-0950756707 0950756709
4	Packaging users Handbook	F.A. Paine , Springer, 1991.	9780751401516 978-1-4613-1483-7 (Online)
5	The Wiley Encyclopedia of Packaging Technology.	Marilyn Bakker, John Wiley & Sons Inc. Canada	0471-80940-3

❖ **E-REFERENCES:**

- <http://www.iiem.com/em/handicrafts/chapter7.html>, assessed on 06/09/2016.
- <http://www.epch.in/seminars/semi082.pdf>, assessed on 09/09/2016.

- <http://www.textilescommittee.nic.in/writereaddata/files/packaging.pdf>, assessed on 12/09/2016.
- http://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/waste/guide_ref/files/chemw_e.pdf, assessed on 14/09/2016.
- <http://www.utar.edu.my/osh/file/Guidelines%20on%20Storage%20Of%20Hazardous%20Chemical%202006.pdf>, assessed on 17/09/2016.
- http://cd1.edb.hkedcity.net/cd/science/laboratory/waste/apx2_e.pdf, assessed on 20/09/2016.
- http://s1.q4cdn.com/259923520/files/doc_downloads/suppliers-terms/packing-standards/Packing-Guide-Cement-bags.pdf, assessed on 22/09/2016.
- <http://www.parcelforce.com/sites/default/files/Retail%20Packaging%20Guidelines%20270313.pdf>, assessed on 22/09/2016.

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

1. Analog Substance Indicator/GSM Tester.
2. Bursting Strength Tester.
3. Universal Testing Machine.
4. Compression Tester- ECT/FCT/RCT, etc.
5. Analog Puncture Strength Tester.
6. Impact Strength Tester.
7. Weighing machine.
8. Drop tester.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. A. P. Pardey	Lecturer in Paper Technology	Government Polytechnic, Nagpur.
5.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
6.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
7.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
8.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: PK504E^s
COURSE TITLE	: PACKAGING OF ENGINEERING GOODS
PREREQUISITE	: 50 CREDITS
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. EXAM	: 01 HR.

❖ RATIONALE:

The business of engineering goods is characterized by centralized production & distribution over a large area. High product costs make packaging an essential consideration in these businesses to prevent losses. Experience over the evolution of technology, market and business has taught us to consider packaging while the product is still on the drawing board. Marketing plays a major role in the field of packaging in the competitive market and hence packaging system needs to be considered very seriously.

The packaging of heavy engineering goods starts right on the drawing board & is a field by itself. Most of the times it's a wise decision, not to provide a pack but the packaging system need to be considered seriously.

Hazardous goods are products by themselves that they are capable of causing damage to the surroundings if they come out of the package and are exposed to the triggering factors. That may lead to a loss of property, loss of lives and irrecoverable damages to human, animal, vegetation health. This calls for a special attention to their packaging.

❖ COURSE OUTCOMES:

After completing this course students will be able to;

1. Identify product characteristics determining packaging functions.
2. Identify associated hazards to a product & its packaging under prescribed conditions of handling, loading & unloading, storage & transportation.
3. Suggest alternative packaging options and select the economical & feasible one.
4. Predict the behavior & performance of recommended/ existing packaging system under various conditions.
5. Identify the packaging consideration for various industrial goods and heavy engineering goods.
6. Perform package evaluation visually.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Refrigerators	1. State the functions, operating principle, types, uses, popular brands, standard models. 2. State the packaging materials used, their form, their functions and main components. 3. Outline manufacturing & packaging line operations. 4. Identify main components & product characteristics. 5. State various considerations and associated hazards. 6. Describe constructional features, various hazards, protections requirements. 7. Describe desirable packaging functions. 8. Describe current packaging practices and functions of various components of it. 9. Suggest alternative packaging options. 10. Compare different options of packaging. 11. Suggest the most economical & feasible packaging option. 12. Select appropriate method of handling, warehousing, loading & unloading. 13. Describe the procedure to carry out various tests & package evaluation. 14. Evaluate package performance.	1.1 Function of refrigerator, operating principle, types, uses and applications, popular brands and standard models. 1.2 Constructional features, outline of manufacturing process, packaging in assembly line. 1.3 Product characteristics, handling considerations and hazards, warehousing considerations and hazards, transportation and distribution considerations and hazards, other desirable packaging functions. 1.4 Most likely and common damages, Protection needs, suitable packaging systems / solutions, current packaging practices. 1.5 Evaluation of packaging system- Technical, technological, economic & commercial, relevant standards.	08
2. Televisions	1. State the functions, operating principle, types, uses, popular brands, standard models. 2. State the packaging materials used, their form, their functions, uses, main components. 3. Outline manufacturing & packaging line operations. 4. Identify main components & product characteristics. 5. State various considerations and	2.1 Operating principle, types, uses and applications, popular brands and standard models. 2.2 Constructional features including built in protection features, outline of manufacturing process, packaging in assembly line.	08

	associated hazards. 6. Describe constructional features, various hazards, protections requirements. 7. Describe desirable packaging functions. 8. Describe current packaging practices and functions of various components of it. 9. Select appropriate method of handling, warehousing, loading & unloading. 10. Suggest alternative packaging options. 11. Compare different options of packaging. 12. Suggest the most economical & feasible packaging option. 13. Describe the procedure to carry out various tests & package evaluation. 14. Evaluate package performance.	2.3 Product characteristics, handling considerations and hazards, warehousing considerations and hazards, transportation and distribution considerations and hazards, other desirable packaging functions. 2.4 Most likely and common damages, Protection needs suitable packaging systems / solutions, current packaging practices. 2.4 Evaluation of packaging system- Technical, technological, economic & commercial, relevant standards.	
3. Electric Lamps	1. List materials used in packaging. 2. List product characteristics, various considerations, hazards, desirable functions of packaging. 3. Identify main components of a package. 4. State the form, function, use of packaging materials used. 5. Describe various hazards, packaging considerations & protection requirements. 6. Find alternative packaging options. 7. Compare the alternative packaging options. 8. Suggest the most economical & feasible packaging option. 9. Select appropriate method of handling, warehousing, loading & unloading. 10. Describe current packaging practices. 11. Describe the procedure to carry out various tests & package evaluation. 12. Evaluate package performance.	3.1 Types of Electric Lamps: Incandescent bulbs, fluorescent tubes, compact fluorescent lamps, miniature bulbs and automobile bulbs 3.2 Product characteristics, handling considerations and hazards, warehousing and retailing considerations and hazards, transportation and distribution considerations and hazards, other desirable packaging functions. 3.3 Most likely and common damages, Protection needs suitable packaging systems / solutions / concepts, current packaging practices. 3.4 Evaluation of packaging system - Technical, technological, economic & commercial, relevant standards.	08

4. Electrical / Electronic Measuring Instruments and Monitoring Devices	1. Define related terms. 2. List various measuring & monitoring devices, examples, applications. 3. Classify measuring & monitoring devices with examples. 4. Identify product characteristics. 5. State the major components. 6. Describe their constructional features. 7. Describe various functional characteristics & their influence on package design. 8. Identify most likely damages, their causes & remedies to prevent those damages. 9. Describe desirable packaging functions. 10. Describe current packaging practices and functions of various components of it. 11. Suggest alternative packaging options. 12. Compare different options of packaging. 13. Suggest the most economical & feasible packaging option. 14. Analyze package & its components. 15. Evaluate packaging.	4.1 Applications of measuring instruments in medical, engineering, industrial, space and aircraft and automobile areas. 4.2 Broad classification of measuring instruments and monitoring devices- digital analogue and hybrid type, examples, common constructional features and components. 4.3 General functional characteristics-accuracy, repeatability, precision, reliability, etc. and their importance for packaging design. 4.4 Most likely physical and functional damages, their causes and remedies in electronic packaging. 4.5 General transit, handling, warehousing considerations and relevant hazards, desired packaging functions. 4.6 Packaging solutions / systems, components of package. 4.7 Evaluation of packaging system- Technical, technological, economic & commercial, relevant standards. 4.8 Special packaging considerations for instruments for panel mounting, field & mobile use, Packaging for assembly line.	08
5. Domestic appliances, Computers and Peripherals.	1. List materials used in packaging, their forms & functions. 2. State product characteristics. 3. State various packaging considerations. 4. Determine various hazards	5.1 Packaging considerations and current packaging practices for the following domestic appliances.	08

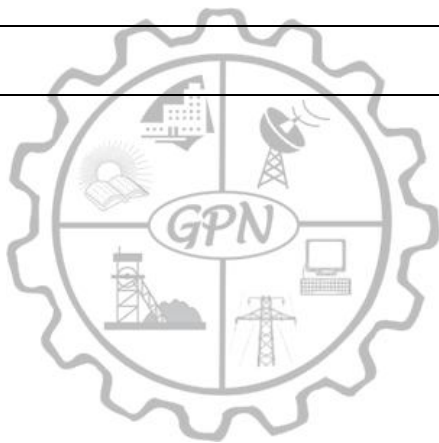
	encountered and probable product damages. - Determine various packaging options. - Select by comparing, the most feasible & economical packaging system. - Describe current packaging practice with identification of various components and their functions. - Analyze package performance. - Evaluate packaging.	- Ceiling fan. - Table fan. - Microwave oven. - Food processor. - Iron. 5.2 Packaging considerations and current packaging practices for the following computing devices and peripherals. - Mouse. - Hard disk. - Compact disks and DVDs. - Keyboards. - Laptops.	
6. Packaging of Heavy Engineering Goods	- Define related terms. - State product characteristics, protection needs, packaging functions, various considerations. - Describe various hazards & likely damages. - Describe various packaging considerations. - Decide whether to pack or not. - Consider options of dismantling & multi-packing. - Consider related laws, regulations, controlling authorities, permits pertaining to packaging & transportation. - Describe common practice of packaging, handling and transportation. - Analyze package performance. - Evaluate packaging.	6.1 Heavy Machinery, vessels and structures: - Characteristics: weight, volume / size, centre of gravity, assembly of components, use of fasteners, overhanging members, protruding members, giant machines, irregularity of shape and size etc, - Protection needs: Likely damages- physical, physiochemical, functional, avoiding damages, options of dismantling and multi-packing, - Handling Considerations: In plant handling, Handling at destination, Handling for transshipment, methods of handling, use of slings and pallets, Handling devices, relevant standards, laws and regulations,	08

		• Transport considerations: Selection of mode and type of load for transportation, Importance of planning the route, local Laws and regulations en-route, permissions and permits of controlling authorities, transit hazards. • Packaging considerations: deciding to pack or not, Basic packaging functions, economics of packaging. 6.2 Heavy Engineering products: • Packaging considerations for metallic coils of wire and thin foils / sheets and bars. 6.3 Export considerations: deciding the mode of transportation and the route, international regulations on handling, transport, marking and labeling, Restrictions on use of packaging materials, disinfection of packages, Use of containers.	
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Pr. No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Evaluate current packaging system for refrigerator - • Visit a nearby vendor. • Observe various models and brands available with their specifications. • Select a model & identify its characteristics. • Identify various hazards encountered by it. • Evaluate packaging system visually. • Write a report on it.	Refrigerator	6
2.	Evaluate current packaging system for television - • Visit a nearby vendor. • Observe various models and brands available with their specifications. • Select a model & identify its characteristics. • Identify various hazards encountered by it. • Evaluate packaging system visually. • Write a report on it.	Television	4
3.	Evaluate current packaging system for electric bulb - • Visit a nearby vendor. • Observe various models and brands available with their specifications. • Select a model & identify its characteristics. • Identify various hazards encountered by it. • Evaluate packaging system visually. • Write a report on it.	Electric Bulbs	4
4.	Evaluate current packaging system for Electric/Electronic measuring/monitoring instruments - • Visit a nearby vendor. • Observe various models and brands available with their specifications. • Select a model & identify its characteristics. • Identify various hazards encountered by it. • Evaluate packaging system visually. • Write a report on it.	Electric/Electronic measuring/monitoring instruments	4
5.	Evaluate current packaging system for Ceiling fan, Table fan, Microwave oven, Food processor, Iron. (Any two) - • Visit a nearby vendor. • Observe various models and brands available with their specifications. • Select a model & identify its characteristics. • Identify various hazards encountered by it. • Evaluate packaging system visually. • Write a report on it.	Domestic appliances, computers and peripherals.	4

6.	Evaluate current packaging system for Mouse, Hard disk, Compact disks and DVDs, Keyboards, Laptops (Any two). • Visit a nearby vendor. • Observe various models and brands available with their specifications. • Select a model & identify its characteristics. • Identify various hazards encountered by it. • Evaluate packaging system visually. • Write a report on it.	Domestic appliances, computers and peripherals.	4
7.	Prepare a report on packaging of Heavy Engineering Goods- Report includes- product characteristic, handling considerations, transport considerations, export considerations for any heavy engineering product.	Packaging of Heavy Engineering Goods	4
Skill Assessment			02
Total Hrs.			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Refrigerators	06(00)	08(00)	06(00)	20(00)
2	Televisions	02(00)	06(06)	04(00)	12(06)
3	Electric Bulbs	02(04)	04(04)	04(00)	10(08)
4	Electrical /Electronic Measuring Instruments And Monitoring Devices	06(00)	04(00)	04(00)	14(00)
5	Domestic appliances, computers and peripherals	02(02)	00(12)	00(04)	02(18)
6	Packaging of Heavy Engineering Goods	00(02)	12(00)	00(06)	12(08)
Total		18(08)	34(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	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	5	R	2	5/7
	6	R	2																
2	1	R	4	1	U	4	4	R	4	3	U	4	3	R	4				3/5
3	3	U	4	2	A	4	3	A	4	5	U	4	5	U	4				3/5
4	1	U	4	4	U	4	4	A	4	5	U	4	5	A	4				3/5
5	1	A	6	2	U	6	2	U	6										2/3
6	6	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	Identification/ observations	20
2	Evaluation /Results	10
3	Report writing	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	3	-
5	-	3	2	2	-	-	-	2	2	3	3	-
6	-	3	2	2	-	-	-	2	2	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.	Fundamentals of Packaging Technology	S. Natrajan, M. Govindrajan, B. Kumar, 2E, PHI LPL, Delhi, 2014	ISBN:978-81-203-5054-0
2.	Handbook on Pulp & Paper Industries	SIRI Board of Consultants & Engineers, SIRI Pub. Div. Delhi.	ISBN:81-85480-24-9
3.	The Wiley Encyclopedia of Packaging Technology	Marilyn Bakker, John Wiley & Sons Inc. Canada.	ISBN:0471-80940-3
4.	The Packaging Designers Book of Patterns	Laszlo Roth, George L/ Wybenga, Wan Nostrand, Reinhold, New York, 1991	ISBN:0-442-00524-5
5.	Paper, Paper Converting, Plastics & Other Pkg. Industries	R. K. Kush, SBP Pub. Co. Delhi, 1998	-
6	Handbook of Pulp & Paper Technology	Kenneth W. Britt, 2E, CBS Publishers Delhi, 1984	-

❖ **E-REFERENCES:**

- <http://www.smurfitkappa.com/vHome/com/Products/Pages/Bakery.aspx>, assessed on 16th June 2016.

- <http://www.bobst.com/chen/industry/packaging-folding-carton/#.VynJ0BKZtq0>, assessed on 18th June 2016.
- <http://www.uctive.com/inspiration/creative-packaging-excellent-designs-of-paper-bags-and-boxes/>, assessed on 11th June 2016.
- <http://www.watermanswebworld.com/code/what.html>, assessed on 19th June 2016.
- <http://www.madehow.com/Volume-1/Corrugated-Cardboard.html>, assessed on 16th July 2016.
- <http://www.fefco.org/corrugated-packaging/production-process-corrugated>, assessed on 6th July 2016.
- <http://boxmaster.com/products/box-basics/>, assessed on 19th July 2016.
- <http://www.fibrebox.org/Info/WhatIsCorrugated.aspx>, assessed on 6th July 2016.
- <http://lithotech.ca/types-of-corrugated/>, assessed on 5th June 2016.
- <http://www.webstaurantstore.com/blog/1138/types-and-sizes-of-corrugated-boxes.html>, assessed on 4th August 2016.
- <http://www.cupmachinery.com/english/process.html>, assessed on 12th August 2016.
- <http://b2b.sulekha.com/pdf/thepapercupmachine3.pdf>, assessed on 18th August 2016.

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

1. Analog Substance Indicator/GSM Tester.
2. Bursting Strength Tester.
3. Universal Testing Machine.
4. Compression Tester- ECT/FCT/RCT, etc.
5. Electronic Thickness Gauge.
6. Analog Puncture Strength Tester.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: PK505E
COURSE TITLE	: PRODUCTION MANAGEMENT & Q. A.
PREREQUISITE	: 50 CREDITS
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 HRS.)
TH. TEE	: 03 HRs.
PR. TEE	: 02 HRs. (Internal)
PT. EXAM	: 01 HR.

❖ RATIONALE:

Modern manufacturing industries have complex production processes. A technician entering into such field comes across various problems involving production processes, methods, planning, scheduling, etc. One has to effectively use the industrial engineering techniques to optimize the resources such as man, machine and material for performance enhancement. Therefore, the knowledge of work-study & work measurement is very essential. The effective control over the inventory of material and equipments also play a vital role.

Due to phenomena of recent global trade policy changes, international competition and firm's question of survival, the strict adherence to quality becomes order of the day. An organization either employed in manufacture, supply, design, test or service area has to maintain strict quality at all levels and the recent dominance of adopting and safeguarding quality systems demand for quality mindedness on part of each of those who contribute to any of the above mentioned areas. Hence the technicians at supervisory level must be fully aware of different aspects of production management & quality control.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Identify basic principles of production management & various techniques to increase productivity.
2. Recognize the need of PPC.
3. Apply basic knowledge of different aspects of quality & S.Q.C.
4. Compute basic SQC functions & standard time from given data.
5. Conduct brain storming session by quality circle and carry out ABC analysis.
6. Draw plant layout & various control charts.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
1. Plant Location & Layout	1. Define related terms. 2. State importance, objectives, types & advantages of a plant layout & its location. 3. Describe various layouts. 4. Recognize the influencing factors for site selection. 5. Differentiate between layouts. 6. Draw a typical layout.	1.1 Importance of location. 1.2 Factors influencing plant location. 1.3 Types of layout such as product layout, functional layout and mixed layout. 1.4 Objectives of plant layout and advantages of plant layout.	08
2. Production, Planning & Control	1. Define related terms. 2. State the types of production, need & objectives of PPC. 3. List examples of various types of production. 4. State activities carried out under production, planning & control. 5. Describe types of production, production procedure and PPC. 6. Distinguish between different types of production. 7. Compare production, planning and control	2.1 Types of production - Job production, batch production, mass production and its examples. 2.2 Production procedure. 2.3 Production, Planning and Control (PPC). 2.4 Need and objective of PPC.	08
3. Inventory Control & Machine Maintenance	1. Define various terminologies. 2. State types of inventories & need of inventory. 3. State the objectives of maintenance & type of maintenance. 4. Describe the replenishment model of inventory, EOQ, ABC analysis. 5. Describe the types of maintenance. 6. Determine EOQ. 7. Distinguish between A, B and C type of inventory. 8. Compare different types of maintenance.	3.1 Inventory- Introduction, types and need. 3.2 Inventory replenishment model (simple). 3.3 Inventory cost relationship, Economic ordering quantity. 3.4 ABC analysis. 3.5 Maintenance – Definition, objectives, types and description of maintenance such as break down, preventive and scheduled maintenance.	12

4. Productivity & Work Study	1. Define various related terms. 2. State objectives of method study & work measurement. 3. List the steps used. 4. State the importance of productivity improvement. 5. Describe various steps of method study. 6. Describe various time & allowances. 7. Determine standard time.	4.1 Definition and concept of productivity. 4.2 Need of productivity improvement. 4.3 Work study and its components. 4.4 Method study and its objectives. 4.5 Steps used for method study. 4.6 Work measurement and its objectives. 4.7 Normal time, standard time & merit rating and standard allowances.	10
5. Different Aspects of Quality	1. Define related terms. 2. State different objectives. 3. State the parameters of E.O.Q., factors influencing vendor rating. 4. Describe various related quality terms like quality of design, quality mindedness, etc. 5. Describe various quality costs, reliability & vendor rating. 6. Describe inspection & quality control. 7. Differentiate between Inspection & quality control, quality of conformance & quality of performance.	5.1 Introduction to quality, quality of design, quality of conformance, quality of performance, reliability, quality circle, quality audit, quality mindedness and vendor rating. 5.2 Economics of quality cost and value. 5.3 Objectives of quality control. 5.4 Inspection and quality control, and difference between them.	12
6. Statistical Quality Control & Standards	1. Define various related terminologies. 2. State importance & objectives of S.Q.C. 3. State the types of - standards, control charts, sampling plans. 4. Describe SQC, Inspection by attributes and variables, normal distribution curve & control charts. 5. Describe acceptance sampling, sampling plans, O.C. Curve. 6. Describe various standards & its various types. 7. Compute basic SQC functions (Mean, Range,	6.1 Definition and importance of SQC. 6.2 Inspection by attributes and variables. 6.3 Normal distribution curve. 6.4 Process capability of a machine, Calculation of Mean, Range, Standard Deviation and Variance. 6.5 Control charts for variables- X-bar chart, R chart (Simple numerical). 6.6 Control charts for attributes- P chart, C chart(Simple numerical). 6.7 Acceptance sampling and sampling plan. 6.8 Concept of O.C. Curve.	14

	Standard Deviation and Variance, etc.) 8. Draw control charts. 9. Interpret control charts.	6.9 Definition of standards. 6.10 Types of standards - Basic, applied, dimensional, performance or quality, test methods, technical terms & symbols, international standards, codes of practice. 6.11 Advantages of standards - for production & testing. 6.12 Levels of standardization - Company standards, national & international standards.	
Total Hrs.			64



B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Pr. No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Draw a plant layout by visiting a nearby industry. - Visit to a nearby manufacturing / conversion industry. - Observe location of equipment in the industry. - Identify various operations and sequence them. - Write a brief report.	Plant Location and Layout & Production, Planning and Control	4
2.	Carry out ABC analysis by categorizing given inventory into A, B and C type items.	Inventory Control & Machine Maintenance	2
3.	Determine Economical Ordering Quantity. - Solve the example and - Plot Inventory replenishment.	Inventory Control & Machine Maintenance	4
4.	Compute Normal time, standard time & merit rating with Standard allowances from the given data.		4
5.	Conduct a brain storming session through Quality Circle. - Form a Quality Circle Group. - Identify problems. - Find alternative solutions. - Suggest the best solution. - Prepare a report.	Quality Control & Different Aspect Of Quality & Quality Function	4
6.	Compute basic SQC functions like - Mean, Range, Standard Deviation and Variance with suitable values/given numerical.	Statistical Quality Control & Packaging Standards	4
7.	Draw control chart (X-bar and R chart) from given data. - Calculate the required mean value. - Calculate UCL & LCLs. - Draw control charts.	Statistical Quality Control & Packaging Standards	4
8.	Draw control chart (P and C chart) from given data. - Calculate the required mean value. - Calculate UCL & LCLs. - Draw control charts.	Statistical Quality Control & Packaging Standards	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	Plant Location & Layout	02(00)	08(04)	00(00)	10(04)
02	Production, Planning & Control	06(00)	04(08)	00(00)	10(08)
03	Inventory Control & Machine Maintenance	02(00)	06(04)	04(04)	12(08)
04	Productivity & Work Study	02(00)	04(06)	04(00)	10(06)
05	Different Aspects of Quality	06(00)	12(00)	00(00)	18(00)
06	Statistical Quality Control & Standards	00(08)	00(00)	10(06)	10(14)
	Total	18(08)	34(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	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	
	6	R	2																5/7
2	2	R	4	4	U	4	5	R	4	6	R	4	2	U	4				3/5
3	1	U	4	1	U	4	2	U	4	1	U	4	2	U	4				3/5
4	3	A	4	4	A	4	6	A	4	3	U	4	3	A	4				3/5
5	5	U	6	5	U	6	4	U	6										2/3
6	3	U	6	6	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	10
2	Performance	20
3	Numerical, calculations, graph and its reading/predictions.	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	1	-	-	-	2	2	3	3	-
5	-	3	2	1	-	-	-	2	2	3	3	-
6	-	3	2	-	-	-	-	2	2	3	3	-

1 – Strong Relationship

2- Moderate Relationship

3- Low Relationship

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Industrial Engg. and Production Management	M.Telsang, S.Chand & Co., 2010	81-219-1773-5
2.	Product Design & Manufacturing	Chitale & Gupta, Prentice Hall of India, 2005	81-203-2636-9
3.	Production Technology	R.K.Jain & Gupta, Khanna Publication, 1981.	978-81-7409-099-1
4.	Quality Control	Paranthaman TTTI, Tata McGraw Hill, 2000	0-07-451620-5
5.	Statistical Quality Control	M.Mahajan, Dhanpat Rai & Sons, 2012	9788177000399, 817700039X

❖ **E-REFERENCES:**

- <http://www.slideshare.net/>, assessed on 11 Oct. 2016
- http://www.improsys.in/SQC_training.htm, assessed on 13 Oct. 2016
- http://en.wikipedia.org/wiki/ABC_analysis, assessed on 16 Oct. 2016

- http://www.slideshare.net/akshay_005/abc-analysis, assessed on 23 Oct. 2016
- http://en.wikipedia.org/wiki/Inventory_control, assessed on 26 Oct. 2016

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

1. Timed flow Liquid filler working model.
2. Thickness Tester.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. 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 PACKAGING TECHNOLOGY
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: PK506E
COURSE TITLE	: MAINTENANCE IN PACKAGING
PREREQUISITE	: 50 CREDITS
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. EXAM	: 01 HR

❖ RATIONALE:

Maintenance is a vital area in industry. Particularly during the era of automation, maintenance has become top most priority. Without maintenance no industry can carry out its production activity with maximum efficiency. Well maintained machines produce fewer defects & faulty productions. Defective or faulty products badly affect productivity of the plant.

The course contents are designed by considering maintenance of packaging machines. Packaging machines run by electrical drives, with mechanical / pneumatic / hydraulic operated mechanisms. Electronic sensors, actuators and PLC are the backbone of these drives. All these need regular basic maintenance which results in scheduled maintenance. This course will help the students to acquire the fundamentals of packaging machine maintenance.

❖ COURSE OUTCOMES:

After completing this course students will be able to -

1. Identify the need of maintenance.
2. Classify various types of maintenance
3. Illustrate the importance of scheduled plan maintenance.
4. Carryout maintenance of various packaging machines.
5. Analyze maintenance records of various packaging machines.
6. Prepare maintenance schedule of various packaging machines.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes	Topics and subtopics	Hrs.
1. Introduction to Maintenance	1. State maintenance and their types, advantages and disadvantages, hazards due to improper maintenance. 2. Describe types, objectives of different types of maintenance and hazards due to lack of maintenance. 3. Describe M.R.O. 4. Compare different types of maintenance.	1.1 Definition, types of maintenance. 1.2 Objectives/need of maintenance. 1.3 Advantages and comparison between them. 1.4 Planed/Scheduled maintenance 1.5 M.R.O. (Maintenance, repairs and overhauling). 1.6 Hazards due to lack of maintenance.	10
2. Maintenance of Packaging Machines	1. List types, operating principle of packaging machines. 2. Describe operating principle and need of multidisciplinary requirements of packaging machines. 3. Describe importance of reliability in packaging machines. 4. Determine different machine components that require maintenance. 5. Analyze life of components.	2.1 Types of packaging machines. 2.2 Operating principles of packaging machines. 2.3 Necessity of multi-disciplinary engineering for packaging machines. 2.4 Identification of machine components which requires maintenance. 2.5 Life of components and reliability of components.	10
3. Maintenance of Mechanical Elements/Components	1. Define lubricants and wear & tear. 2. State importance of history sheet and components needing mechanical maintenance. 3. Describe importance of history sheet. 6. Determinations of mechanical machine components require maintenance.	3.1 Lubrication. 3.2 Wear and tear. 3.3 Importance of history sheet. 3.4 Identification of components needing maintenance. 3.5 Power transmission, bearings, clutches pumps, valves, compressors, mechanical actuators, and motion/force transmitting mechanisms. 3.6 Power tools.	12
4. Maintenance of Electrical & Electronic Components	1. State electrical & electronic components needing maintenance, types of sensors & functions of each. 2. Describe need of maintenance for electrical drives &	4.1 Need of maintenance in electrical drives. 4.2 Life and reliability of electronic elements, physical requirements of components.	12

	elements. 3. Describe physical requirements for electrical and electronic elements. 4. Describe cleaning requirements for sensors and maintenance need for insulators. 5. Determine reliability and life prediction for electronic components.	4.3 Types of sensors and their cleaning requirements. 4.4 Insulator maintenance.	
5. Maintenance of Hydraulic and Pneumatic Components	1. State elements/accessories of hydraulic and pneumatic systems & actuators, function & importance of elements. 2. Describe hydraulic and pneumatic system in packaging machinery. 3. Describe importance of accessories/actuators in hydraulic & pneumatic systems and maintenance need for it. 4. Determine maintenance requirements of hydraulic and pneumatic systems.	1. Need of hydraulic and pneumatic system in packaging machinery. 2. Importance of filters and other accessories in hydraulic & pneumatic systems in packaging machines. 3. Pneumatic and hydraulic actuators and maintenance requirements.	10
6. Productivity and Cost Considerations	1. Define Productivity. 2. State cost related to maintenance and life cycle cost. 3. Productivity, maintenance productivity, Interrelation between maintenance & productivity. 4. Describe different types of costs involved in maintenance. 5. Determine the process to minimize total maintenance cost.	1. Productivity, maintenance productivity. 2. Four types of Cost in Maintenance - I. Cost to replace or repair. II. Losses of output. III. Delayed shipment. IV. Scrap and rework. 3. Direct and indirect cost of maintenance. 4. Life cycle cost.	10
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Sr. No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Carry out mechanical maintenance on universal testing machine and box compression machine. - Go through manufacturer's manual. - Determine assemblies needing scheduled maintenance. - Identify all mechanical components which need maintenance/lubrication. - Clean & make the components dust free. - Lubricate with appropriate recommended lubricants. - Write a report.	Maintenance of Packaging Machines & Maintenance of Mechanical Elements/Components	4
2.	Carry out hydraulic maintenance on bursting strength tester. - Go through manufacturer's manual. - Determine lubricants used in hydraulic system & for machines maintenance. - Identify all mechanical components which need maintenance/lubrication. - Clean & make the components dust free. - Lubricate with appropriate recommended lubricants. - Inspect hydraulic lubricant level in the system. - Fill/change the lubricant if it is required. - Write a report.	Maintenance of Packaging Machines & Maintenance of Hydraulic and Pneumatic Components	4
3.	Carry out electrical maintenance on Corrugator - Go through manufacturer's manual. - Disassemble flutter roller assembly. - Replace resistance of corrugator roller. - Check electrical connections carefully, verify phase and earth if any. - Assemble it. - Write a report.	Maintenance of Electrical & Electronic Components	4
4.	Carry out minor electrical maintenance on various machines available in the department. - Carefully go through assigned task. - Find out exact fault in the machine - Replace/repair electrical on-off switches, push buttons and toggle switches, etc. - Check electrical connections carefully, verify phase and earth if any. - Write a report.	Maintenance of Electrical & Electronic Components	4

5.	Visit to a packaging industry and analyze maintenance record. • Collect information on breakdown, preventive and scheduled maintenance & collect various formats used. • Observe repeated types of fault and its frequency. • Study the type of fault and remedial action taken. • Compile the information of time requires for rectification every time. • Calculate production loss, replacement cost, scrap or rework cost.	Maintenance of Mechanical Elements/Components & Productivity and Cost Considerations	6
6.	Prepare a scheduled maintenance calendar for a machine. • Visit to any industry. • Collect maintenance record of last 2-3 years. • .Go through machine manuals. • Observe the pattern, frequency and exact maintenance work carried out. • Identify machine. • Collect history sheets. • Work out preventive schedule so that breakdown maintenance will reduce to minimum. • Write a report.	. Introduction to Maintenance & Maintenance of Mechanical Elements/Components	8
Skill Assessment			2
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction to Maintenance	06(02)	08(00)	00(00)	14(02)
2	Maintenance of Packaging Machines	06(00)	00(06)	06(04)	12(10)
3	Maintenance of Mechanical Elements/Components	06(00)	00(08)	06(00)	12(08)
4	Maintenance of Electrical & Electronic Components	02(00)	12(04)	00(00)	14(04)
5	Maintenance of Hydraulic and Pneumatic Components	02(04)	06(00)	00(06)	08(10)
6	Productivity and Cost Considerations	00(06)	04(00)	06(00)	10(06)
	Total	22(12)	30(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	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	5/7
	1	R	2																
02	1	R	4	2	R	4	3	R	4	5	R	4	6	R	4				3/5
03	1	U	4	1	U	4	6	U	4	3	U	4	3	U	4				3/5
04	4	U	4	4	U	4	4	U	4	4	U	4	2	A	4				3/5
05	2	A	6	3	A	6	2	U	6										2/3
06	5	U	6	6	A	6	5	A	6										2/3

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Problem finding	10
2	Performance – trouble shooting.	20
3	Result / 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	-
4	-	3	2	1	-	-	-	2	2	3	3	-
5	-	3	2	-	-	-	-	2	2	3	3	-
6	-	3	2	-	-	-	-	2	2	3	3	-

1 – Strong Relationship

2- Moderate Relationship

3- Low Relationship

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Maintenance Engineering and Management	R. C. Mishra, K. Pathak, PHI learning private limited second edition, April 2012.	978-81-203-4573-7
2.	Oil Hydraulic systems, Principles and maintenance	S.R.Mujumdar, Tata McGraw-Hill publishing company limited, 2006. (Thirteenth Reprint)	0-07-463748-7
3.	Fundamentals of Automation Technology	F. Ebel, S. Idler, G. Prede, D. Scholz, 2008.	--

❖ **E-REFERENCES:**

1. https://lehrerfortbildungbw.de/faecher/nwt/fb/atechnik/grundlagen/en/kapitel/563060_Fundamentals_of_automation_technology.pdf-, assessed on 11th Nov 2016
2. <http://een.iust.ac.ir/profs/esmaeilzadeh/instrumentation/Practical%20Instrumentation%20for%20Automation%20and%20Process%20Control-IDC.pdf>, on 11th Nov 2016

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

1. Bursting Tester.
2. Box Compression Machine.
3. Universal Testing Machine.
4. Vibration Tester.
5. Corrugating machine.
6. Injection Molding Machine.
7. Extrusion Blow Molding Machine.
8. Semiautomatic Screen Printing Machine.

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

Sr.No.	Name	Designation	Institute / Industry
1.	Mr. R.S. Raool	I/C Head of Packaging Technology.	Government Polytechnic, Nagpur.
2.	Mr. A.S. Bhagat	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
3.	Mr. I. A. K. Syed	Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
4.	Mr. S.N. Madhugiri	Ex. Head of Department, Packaging Technology	Government Polytechnic, Nagpur.
5.	Mr. P.P. Sargaonkar	Ex. Lecturer in Packaging Technology.	Government Polytechnic, Nagpur.
6.	Mr. M.S. Deshpande	BTE Repetitive & Lecturer in Mechanical Engineering.	Government Polytechnic, Bramhapuri.
7.	Mr. Suresh Thakur	Industry Expert, Managing Director.	Palekar Food Products, MIDC, Amravati.

 (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)

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GOVERNMENT POLYTECHNIC, NAGPUR.

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/EE/EC/CM/IT/ TX/MT/PK
LEVEL NAME	: ELECTIVE COURSES
COURSE CODE	: FE501E
COURSE TITLE	: BASIC BUILDING DRAWING
PREREQUISITE	: NIL
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR)
TH.TEE	: NIL
PR.TEE	: 02 HRs (Internal)
PT	: NIL

❖ RATIONALE:

Various agencies involved in engineering works use drawings as effective medium of communication. Engineering professionals of fields, other than civil engineering like mechanical, electrical, chemical, polymer mining, metallurgy etc. are required to interpret the space in the given building to assess whether their installations can be housed in the building or to specify the space requirements of their machineries, assemblies and installations. Moreover as an individual everyone of any profession wants to visualize his/her home before it is build, therefore these professionals need to study basic of building drawings such as plan, elevation and sections etc. This curriculum is designed to develop the basic skills of drawing building plan, elevation and section.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify different types of lines and symbols used in working drawings.
2. Prepare line plans of buildings for different orientations and with different scales.
3. Prepare plan, elevation and section of an existing building by taking measurements.
4. Develop working drawing duly considering rules, regulations and byelaws of sanctioning authority.
5. Identify the units and their sizes required in a building for serving a given purpose.
6. Interpret plan, elevation and section of building.

❖ **COURSE DETAILS:****A. THEORY :**

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

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Draw different types of lines, common notations/symbols used in civil engineering and also symbols used in their field to be shown in the plan (A1size sheet).	Basics of Civil Drawing	10
2	Prepare line plans of small residential building (1BHK) for different plot orientation and with different scale on graph paper (A1size).	Drawing line plans	10
3	Prepare line plans of Public building like (Primary school building and Primary Health Centre) specifying names and sizes of different units. Prepare a separate report giving units, their sizes and justification for sizes.		10
4	Prepare a Measured drawing of institutional workshop/any small building. Show placement of machines/electrical fixtures etc.	Measured drawing	12
5	Develop a working drawing of any one of the building drawn in Practical no.2 considering rules, regulations and bye laws of local /other sanctioning authority.	working drawing	12
6	Draw plan and sectional elevation of Bifurcated/ Dog legged staircase.		06
7	Interpret dimensions and sizes of various units in the given building drawing.	Interpretation	04
Total			64

❖ ASSESSMENT AND EVALUATION SCHEME:

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Draw to the suitable scale a detailed plan of two room building.	20
2	Dimensioning	10
3	Neatness	10
4	Viva -Voce	10
	TOTAL	50

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Building Drawing: With an Integrated Approach to Built Environment	M.G. Shah, C.M.Kale and V. Y.Patki Tata McGraw-Hill Publishing Company Ltd. 4 th edition, 2002	10:0074638769
2.	Building Planning and Drawing	Dr.Kumara Swamy and A. Kameshwara Rao , Charotar Publications , 8th edition, 2015	13:9789385039126
3.	Civil Engineering Drawing and House planning	B.P.Verma, Khanna Publications, 11 th Edition,1986	13:9788174091688
4.	Civil Engineering Drawing	Gurucharan Singh, Standard Publications, 2009	13:9788180140044
5.	Civil Engineering Drawing	R. S. Malik,G.S. Meo, Computech Publications ltd./ New Asian Publications, 5 th edition, 2015	13:9788173180026

❖ **E-REFERENCES:**

1. <http://bie.telangana.gov.in/Pdf/civilenggdrawing.pdf>, accessed on 3rd September, 2016
2. <http://www.iar.unicamp.br/lab/luz/ld/Arquitetural/livros/interior%20design%20student%20handbook.pdf>, accessed on 3rd September, 2016.
3. <https://law.resource.org/pub/in/bis/S03/is.962.1989.pdf> accessed on 3rd September, 2016
4. http://civilengineering-notes.weebly.com/uploads/1/1/7/5/11750056/building_bye_laws.pdf accessed on 3rd September, 2016
5. <http://civil.emu.edu.tr/courses/civ1103/Tutorial%205.pdf> accessed on 3rd September, 2016

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

Nil

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

S.N.	Name	Designation	Institute / Industry
1.	Mr. R. N. Giradkar	Head of Civil Engineering Deptt.	Government Polytechnic, Nagpur.
2.	Dr. D. N. Kongre	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
3.	Mr. S. R. Kukadapwar	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
4.	Mr. M. K. Panchwate	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
5	Dr. S. J. Nikam	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
6	Mr. M. R. Shelote	Consultant Engineer	M. R. Associates, Nagpur.
7	Dr. R. N. Khapre	Associate Professor	Ramdeobaba College of Engineering and Management, Nagpur
8.	Mr. A. J. Fulzele	Assistant Secretary (Technical)	MSBTE, Regional Office, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

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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.

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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:

Practic als	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 irctc.co.in etc.	6. Introduction to E-Governance	2
21.	Connect through E-governance railway website on the internet and learn the procedure for online railway reservation.		2
Skill Assessment			4
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:NIL**❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:NIL**

❖ **ASSESSMENT AND EVALUATION SCHEME:**

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

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection, writing steps, installation etc.	10
2	Connection and configuration.	10
3	Performance	20
5	Viva voce	10
	TOTAL	50

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

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

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

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year Of publication	ISBN Number
1.	Computer Networks	Andrew S Tannenbaum, Tata McGraw-Hill Edition, 2012	9780132126953
2.	Fundamentals of computer	E Balaguruswamy, Tata McGraw-Hill Education Pvt. Ltd., 2009	9780070141605
3.	Computer Basics	Micheal Miller, Tata McGraw-Hill Edition, 2012	0789734206
4.	Complete Reference Networking	Craig Zacker, Tata McGraw-Hill Edition	0132126958

❖ **E-REFERENCES:**

<http://www.pcworld.com/article/116583/article.html> , assessed on 20th April 2016

<http://www.computerstepbystep.com/computer-maintenance.html> , assessed on 20th April 2016

<https://www.youtube.com/watch?v=a0rEXzyX0-8>, assessed on 20th April 2016

❖ **LIST OF MAJOR COMPONENTS/DEVICES WITH THEIR SPECIFICATION.**

1. Operating System(Windows 98/2000/XP/7/8/8.1/10)
2. CPU Intel core i3/i5/i7
3. Hub(4 port USB hub, TB-226)
4. Switches
5. Connectors(RJ45/BNC/AUI/FIBER)
6. Printers(INK JET/LASER)
7. Scanner(FLAT BED)
8. Crimps, Strips and cut tools(HT-200R, HT-2008R)

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

S.N.	Name	Designation	Institute / Industry
1	Mr. S.P. Lambhade	Head of Computer Engineering	Government Polytechnic, Nagpur.
2	Dr. Mrs. A.R. Mahajan	Head of Information Technology	Government Polytechnic, Nagpur.
3.	Ms. Shifa S. Sayyed	Lecturer in Information Technology	Government Polytechnic, Nagpur.
4.	Mrs. V A Raje	System Analyst(Lecturer in Computer Engineering)	Government Polytechnic, Nagpur.
5.	Ms. Gayatri B. Chavan	Lecturer in Computer Engineering	Government Polytechnic, Nagpur.
6.	Shri. Atul Upadhyay	COE	Vista computers, Ramnagar, Nagpur
7.	Shri N. V Chaudhri	Asst. Professor (CSE)	DBACEO ,Wanadongri, Nagpur
8.	Shri Manoj Jethawa	HOD, Computer Science	Shri DattaMeghe Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(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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(Chairman PBOS)

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.

(An Autonomous Institute of Govt. of Maharashtra)

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: 100-140 PSI. 2 Press plates included (designs may vary) Air inlet fitting: 1/4" NPT
- ❖ Socket/ Impact wrenches- 1/4", 3/8", 1/2" and 3/4"
- ❖ Torque wrenches- 3/8", 1/2" and 3 NM, Ratcheting type/Click-type.
- ❖ Driving simulator.
- ❖ Road signs.
- ❖ Vehicle with two paddle control.

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

S.N.	Name	Designation	Institute / Industry
1.	Dr.K.S.Dixit	I/C, Head of Automobile Engineering	Government Polytechnic, Nagpur.
2.	Mr. S.D.Thakre	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
3.	Mr. R.B.Tirpude	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
4.	Mr. Syed J.M.	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
5.	Mr. V.S.Kumbhar	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.
6	Mr. A.R.Yadgire	Lecturer in Automobile Engineering	Government Polytechnic, Nagpur.

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GOVERNMENT POLYTECHNIC, NAGPUR.

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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.Balasubbarreddy 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)

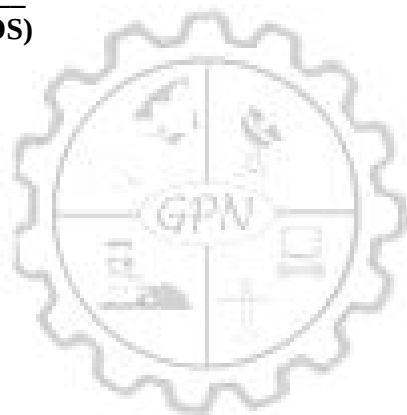
❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

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
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	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**

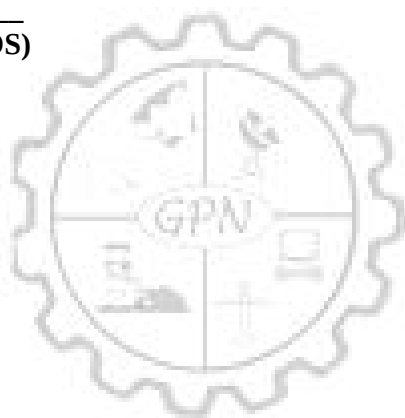
- ❖ As per requirement of related field.

❖ **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 Packaging Technology Program

To Promote Professional Standards and Competency through Education and Training to Create a World Class Packaging Diploma Engineer.

Mission of the Automobile Engineering Program

- M1:** To develop competent packaging professionals for the industry and society by providing world class teaching learning facilities.
- M2:** To provide Educo-healthy environment that help developing lifelong learning attitude within the student and the staff.
- M3:** To produce environmentally conscious entrepreneurs by imparting quality education.
- M4:** To develop soft skills and inculcate ethics to make a versatile personality.

Program Educational Objectives - PEOs

- PEO 1:** To create the technical manpower for Packaging and allied industries enriched with basic technical knowledge and skills of packaging materials & methods, package conversion, testing, designing and decoration.
- PEO 2:** To serve the society and the nation by developing technocrats with reasonable understanding and inclination to environmental aspects & sustainability.
- PEO 3:** Develop the attitude for life-long learning and professional advancement through self-study and continuing education or professional studies in Packaging Technology.
- PEO 4:** To produce entrepreneurs who will be able to start his own enterprise on at least small scale basis this will enable him not only to earn his livelihood but also to provide job opportunities to others; hence contributing towards nation building.
- PEO 5:** To communicate effectively, encourage colleagues and subordinates, maintain values, positive attitude, interpersonal relations and deal effectively with people to achieve personal and organizational goals.

Program Specific Outcomes - PSOs

- PSO1 :** Supervise packaging processes.
- PSO2 :** Test and evaluate package and its applied parts.

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.



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