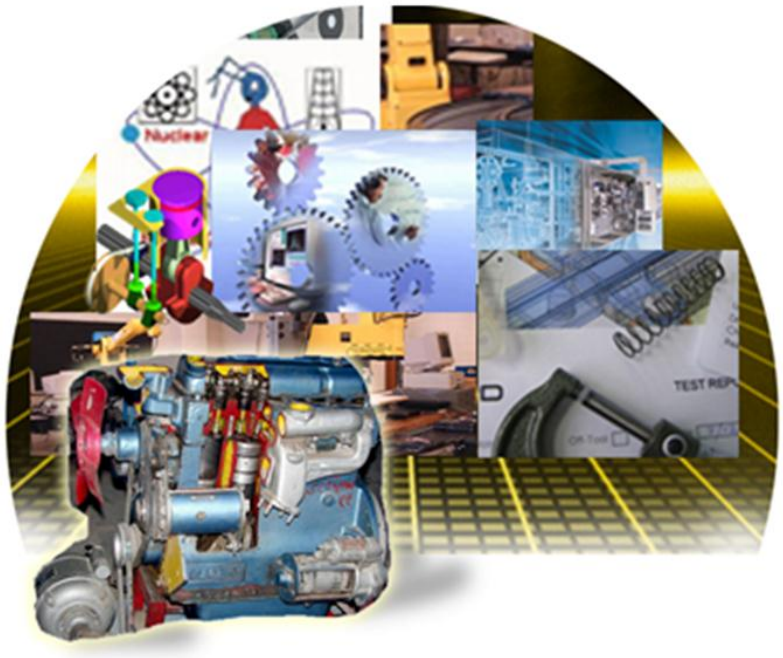
GOVERNMENT POLYTECHNIC, AURANGABAD.

(An Autonomous Institute of Govt. of Maharashtra)

Curriculum for Diploma in Mechanical Engineering



Sixth Revision (2017-2018)

Based on Outcome Based Education Philosophy

Government Polytechnic, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

Sixth Revision Outcome Based Curriculum Document

2017-2018

Department of Mechanical Engineering

CERTIFICATE OF PBOS

This is to certify that the Curriculum of Diploma in Mechanical Engineering Programme has been revised to be implemented from academic year 2017-2018 The outcome based curriculum is hereby approved program wise board of studies.

Shri Purushottam S. Maslekar
Operation Head
ENDURANCE TECHNOLOGIES LTD, MIDC Waluj
Member (Board of Studies & Program Board of Studies)

Shri G. K. Chahal
Industry Consultant, Aurangabad
Program Board of Studies Member

Shri Onkar S. Joshi
Industry Consultant, Aurangabad
Program Board of Studies Member

Head
Mechanical Engineering.
Govt. Polytechnic Aurangabad

In Charge
Curriculum Development Cell
Mechanical Department
Govt. Polytechnic,Aurangabad

Principal
Govt. Polytechnic,Aurangabad

CERTIFICATE OF BOS

This is to certify that the curriculum of Diploma in Mechanical Engineering Programme has been implemented with effect from academic year 2017-2018.

This Curriculum Document contains pages from 1 to ----

Department Coordinator
Mechanical Engineering Department
Government Polytechnic, Aurangabad

Head of the Department
Mechanical Engineering
Government Polytechnic, Aurangabad

I/C CDIC
Government Polytechnic, Aurangabad

Principal
Government Polytechnic, Aurangabad

Chairman Board of Studies
Government Polytechnic, Aurangabad

CERTIFICATE OF EQUIVALENCE

This is to certify that the Curriculum of Diploma in Mechanical Engineering Programme of Govt. Polytechnic Aurangabad (An Autonomous Institute of Govt. of Maharashtra) ,which has been implemented with effect from 2017-18 academic year, is equivalent to Diploma in Mechanical Engineering Programme Implemented by Maharashtra State Board of Technical Education, therefore Equivalence is hereby granted as below.

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Bandra (East), Mumbai – 400 051. (ISO 9001 : 2008) (ISO/IEC 27001 : 2013)

EQUIVALENCE CERTIFICATE

This is to certify that, the following Diploma programmes run by **GOVERNMENT POLYTECHNIC, AURANGABAD** are Equivalent with Diploma Courses offered by **MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI** at the state level.

Sr.No.	Name of the Full time Programme Offered by Govt. Poly., Aurangabad	Name of the Equivalent Course of MSBTE
1.	DIPLOMA IN CIVIL ENGINEERING	DIPLOMA IN CIVIL ENGINEERING
2.	DIPLOMA IN MECHANICAL ENGINEERING	DIPLOMA IN MECHANICAL ENGINEERING
3.	DIPLOMA IN ELECTRICAL ENGINEERING	DIPLOMA IN ELECTRICAL ENGINEERING
4.	DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGINEERING	DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGINEERING
5.	DIPLOMA IN COMPUTER ENGINEEING	DIPLOMA IN COMPUTER ENGINEEING
6.	DIPLOMA IN INFORMATION TECHNOLOGY	DIPLOMA IN INFORMATION TECHNOLOGY
7.	DIPLOMA IN AUTOMOBILE ENGINEERING	DIPLOMA IN AUTOMOBILE ENGINEERING
8.	DIPLOMA IN DRESS DESIGN& GARMENT MANUFACTURING	DIPLOMA IN DRESS DESIGN& GARMENT MANUFACTURING

The Academic Equivalence granted to above programmes with the respective MSBTE courses is valid for the Academic Year **2017-18 to 2019-20.**

Director

No. MSBTE/D-53/Auro. Poly. /GPA'badEqv 2017-20/2018/3280 Dated: 14 MAY 2018

PREFACE

Government Polytechnic, Aurangabad, one of the oldest institute in Maharashtra was established in the year 1995-96. Over the period of time the institute, through its untiring efforts has created its own niche and has been functioning as a Lead Technical Institute in the State of Maharashtra to serve the Industry and Society by producing excellent technical manpower.

Government Polytechnic, Aurangabad has expanded quantitatively from an intake of 180 in 1995 with three programmes to 720 Intake in eight programmes. The Institute has been striving relentlessly for achievement of excellence in technical education. Government Polytechnic, Aurangabad has been functioning with 'the Autonomous Institute status', since 1994.It is presently functioning in three shifts, by running Diploma Programmes in I Shift (Regular), II shift and Part Time Diploma programmes in evening shift. I am proud to share that , the Institute has been ably rewarded with three state level awards for its best performance in the state of Maharashtra.

Institute has revised the curricula five times in the past and the sixth revision which was due, was initiated in the year 2015 and finally , the revised(sixth) curricula which is the outcome of, search conference under the guidance of NITTTR, Bhopal ,several workshops and deliberations, has been implemented with effect from 2017-18 with the approval of Programme wise Board of Studies (PBOS) Board of Studies (BOS) and consent of Governing Body .

The hallmark of sixth revision is, adopting 'Outcome Based Education Philosophy' as the basis for Curriculum Design and Development process. The 'Vision & Mission' of Institute and programme offering Departments, and with programme Educational Objectives (PEOs) ,Programme Outcomes as mandated by National Board of Accreditation (NBA) have been considered as points of reference for curriculum revision. Taking into account the need/ demand of industry and society, the courses such as ' Vocational Training (Industrial/ In-plant Training), Seminar and Development of Life Skills for all the programmes have been introduced as compulsory. To accommodate these additional courses and other requirements, the credits of each programme have been enhanced from 184 to 194.

'Skill India', 'Digital India 'and ' Make in India' the flagship programmes/ initiatives of Government of India and State of Maharashtra have been the basic considerations in the curriculum revision process.

I deem this is as an opportune moment to recall the following proverb/quote which I view as highly relevant ,on the occasion of writing the preface.

"If you are planning for a year, sow rice; if you are planning for a decade, plant trees; if you are planning for a lifetime, educate people." – a Chinese proverb *&*

As the Indian Education Commission of 1964-66, also known as the *Kothari Commission*, it is stated that

"The destiny of our country is being shaped in our classrooms".

I take great pride in appreciating the efforts of Faculty of all Departments. All Faculty have taken determined efforts under the guidance of NITTTR Bhopal, Industry experts , academicians and Curriculum Development & Implementation Cell (CDIC) in the revision of curricula. I appreciate the contribution of alumni, students and faculty by making valuable suggestions / feedback for the revision of curricula.

I wish to assure, that the curriculum of all programmes will be implemented in true spirit to achieve the intended educational objectives of the programme.

(Prof. F.A.Khan)
Principal
Government Polytechnic,
Aurangabad

VISION AND MISSION STATEMENT OF INSTITUTE

VISION

"To be the internationally accredited institute that contributes in the development of competent professionals & entrepreneurs on the platform of technology based systems, blended learning and training for highly qualified and trained staff".

MISSION

"To educate and train the students for globally competent individuals, professionals, technicians and skilled human resources through world class-curriculum, student centric academic systems, team of committed, trained faculty and staff contributing to the student's, successful employment and entrepreneurship with a spirit of patriotism & concern for environment".

VISION AND MISSION STATEMENT OF DEPARTMENT

VISION

Center of excellence for employability and entrepreneurship through blended learning, incubator and collaborative practices.

MISSION

1. Development of competent students for employability and entrepreneurship.
2. To encourage students to participate in technical competitions.
3. Exposure to the industrial practices.
4. To create a sense of social and environmental concern by inculcating humanitarian and ethical responsibilities.

SCOPE OF DIPLOMA IN MECHANICAL ENGINEERING

Mechanical, the versatile branch of engineering plays a cardinal role for multifaceted, rapid and sustainable socio-economic development of the nation covering each and every aspect of human life. It is concerned with the power generation, production, design and manufacturing, fabrication, automobile, refrigeration and air-conditioning, quality assurance, quality control etc. It is a bedrock upon which the survival and prosperity of whole industrial world rests.

We live in a world of constant change and globalization has changed the ways of organization functions. Customers occupy the focus of business and there is utmost need for an organization to become more creative with the ability to generate marketable products, practices and processes. Today prime motive of the industries is cost reduction, enhanced productivity, technology integration, automation and value addition. To be in tune with the industrial environment. The strong, innovative and well-qualified technical manpower is pre-requisite. They must be able to design and give solutions to the problems in the real world.

Tremendous progress has been made in the field of mechanical engineering such as innovation in design. Tools, equipments and materials with the help of state of art products and services.

This demands technicians of multiple skills and knowledge facets. The blend of mechanical with other branches as a wide professional practice has experienced the surge of growth and outcome of this is the transformation of industries to produce heavy duty sophisticated machine tools and equipments having higher precision and functionality. This made technicians and engineers from mechanical to adopt interdisciplinary and integrated approach. Such type of technicians and engineers is the demand of today's industrial world. Therefore the diploma in mechanical engineering envisages in developing competent technicians with a number of professional skills who can perform their jobs in the industries or as an entrepreneurs effectively and efficiently. In industries, in small businesses or in educational establishments, the mechanical technicians with necessary skills will be able to plan, maintain, design and manufacture, handle advanced machineries and equipments, deliver management functions and have a capacity to improve the existing system and develop new methods.

Mechanical engineering is a perennial flow of advanced technology stream and the most crucial component with great potential for adding value to the products and services for contributing to the national economy. Thus mechanical engineering has become an integral part of every aspect of human progress.

AREA OF WORK/EMPLOYMENT:

S. No.	Type of industries/ organizations	Capacity (Designation) in which employed
1	Self owned industry	Entrepreneur/proprietor/Design engineer/Production executive/ Unit In charge/ Stores Officer
2	Private /Public Limited Companies	Supervisor, Technician, Maintenance Engineer, Quality control Engineer, Vendor development engineer, Store manager, Planning engineer, Development engineer, Design engineer, Marketing Executive, Testing and quality assurance engineer, computer engineer, CAD Designer, Shift engineer
3	Banks, financial corporation	Sales executive, Product Development Executive, surveyor, recovery executive, system in charge, project manager, software development engineer, system maintenance engineer
4	Indian Railways	Loco Pilots, production engineers, Maintenance engineer, Quality control engineer, supervisor, testing and QC Manager
5	Indian army	Junior Technical Officer (Short and Long term commissions)
6	Indian Air force	Ground technicians, Ground engineers
7	Automobile Industries	Production supervisor, Vehicle testing Engineer, Engine testing engineer, Vehicle quality assurance executive, CAD CAM Engineer,
8	Transport Department	Assistant Motor Inspector (AMVI)
9	Indian Merchant Navy	Junior Technical Officer (Mechanical)
10	Communication Sector	Junior Telecom Officer (Mechanical), Marketing engineer
11	Entrepreneur	Proprietor

JOB FUNCTIONS

Sr. no.	Designations of the diploma holders in various employment	Job functions
1	Entrepreneur	Project Management Plan, estimate, procure and install hardware and software systems. Analyze and design systems Administer and manage networks Marketing skills
2	Supervisor/ Production Engineer/ Production Manager	Supervisor production Plan and execute production schedule Arrange for material and tools supplied for production Supervise and guide workers for quality production Train the workers for new production process/ operations Ensure quality in production Handle labour problems Ensure safety in production Maintenance of progress of production
3	Maintenance engineer	Prepare schedule for preventive as well as routine maintenance Organize physical as well as human resources for implementation of maintenance Execute maintenance work as per schedule Obtain / make progress report of maintenance at regular intervals and report to higher authorities
4	Quality control / inspection/ quality	Applications of statistical methods to check quality of production

	assurance engineer	Apply and monitor the quality systems like KAIZEN, CANBAN, ZERO DEFECT systems TQM on shop floor Inspection of quality control from raw material procurement to finished goods Monitor Just In Time Procurement method Guidance to operators at intermediate stages of production To attain Total Quality Management Educate operators about global quality concept and customer focused quality aspects
5	Sales /marketing engineer	Execute the marketing strategies of product Interact with customers and sale the product Plan and participate in marketing campaign of product Carry out market survey Plan for selling for achieving the targets of product
6	CAD./ CAM engineer/R &D engineer	Make the product/ part drawing in CAD software like PRO-E, CATIA, SolidWorks and Auto CAD etc Modeling of the parts and assemblies Make the CNC programmes from component parts, CAD drawing and execute production cycles on the machines Interact with production and other departments for feedback of design
7	Loco Pilots	Run the loco trains as per schedules Plan and make regular operational maintenance Follow safety procedures during loco driving
8	Junior Technical Officer (Indian Army)	Operate/ test the mechanical equipment in army like engines of trucks jeeps. Tanks cannon, generator Maintain the mechanical equipments of armed forces

		Participate in war front and operate / maintain the mechanical equipment
9	Ground engineer / Technician (Indian Air Force)	Operate and maintain mechanical equipment of air force like engines, turbines, cranes etc. Regularly maintain the above mentioned equipment Participate in war front and maintain above equipment
10	Assistant Regional Transport Officer (ARTO)	Control the transportation activities Act as license, Registration and vehicle passing authority Control the pollution by automobiles by regulating PUC norms
11	Junior telecom officer	Erection/ maintenance of Telecom systems and Telephone exchange networks
12	Junior Technical Officer (Navy)	Operate/ maintains various boilers, turbine, generators on ship Maintain missile systems onboard of ships

SKILL IDENTIFICATION FOR MECHANICAL ENGINEERING

- Development of personality, communication and generic skills in the Mechanical Engineer.
- Acquiring working knowledge of engineering science.
- Acquiring working knowledge of engineering mechanics.
- To prepare and interpret product drawings as per IS code.
- To become familiar with basic workshop processes.
- To acquire working knowledge of various production process, metal forming and finishing process.
- To acquire working knowledge of Heat Power Engineering areas.
- To identify mechanisms and select the component for operation and maintenance of various machines.
- To identify and operate maintenance of various Electrical and Electronic devices.
- To identify and operate maintenance of various Electronics circuits and controls related to mechanical field.
- To select, install and operate hydraulically / pneumatically operated devices, circuits, devices and pumps.
- To acquire skills for automation applications.
- To use computer for mechanical engineering applications.
- To select appropriate materials and allied process for various mechanical components and applications.
- To become conversant with professional and commercial practice.
- To become conversant with basics of measurements and instrumentations.
- To understand fundamentals of various thermodynamics system with a view of their effective operation and maintenance in practice.
- To understand mechanisms used in practical machines and equipments with view of operation and maintenance of machines.
- To get acquainted with metallurgy and manufacturing process and materials with a view to operate them effectively in practical situation.

- To understand basics and fundamentals of industrial engineering and world class manufacturing practices so as to apply them in practice.
- To develop logical approach for problem solving in mechanical engineering areas using programming language i.e. Visual basic, etc.
- To understand fundamental concepts of basics of CNC machines and develop the skills of part programming.
- To understand and get proficiency in handling the measuring instruments in the practical situations.
- To operate and maintain the automobiles by understanding the basic and principles.
- To understand the latest developments in software and Automation.
- To develop Entrepreneurial skills.
- To create environmental conscious.
- To design press tools, forging dies, moulds, etc.
- To interpret using with easy drawing.
- To be able to plan the process for manufacturing a component as per part drawing.
- To acquire the skills in 2D & 3D modeling using different software.

CURRICULUM DESIGN & DEVELOPMENT

- Different courses are categorized as.
  - Foundation Level
  - Basic Level.
  - Allied Level.
  - Applied Level.
  - Diversified Level.
- Curriculum scheme of each course along with course code is given at the beginning.
- Competencies to be developed are identified and written.
- Rationale of each course is highlighted.
- Objective of each course is highlighted and written.
- Content outline is in descriptive form. Generally the content outline of a subject was divided into chapters and then from chapters into topic outline.
- Having derived the total content outlines i.e. Theory. At the end of the theory content list of practicals is added for each course.
- Time required by a teacher to teach the prescribed theory and practical parts is mentioned.
- Number of courses per term to be taken is specified.
- Total no. of hours required to teach the entire course is mentioned.
- Total no. of lectures and practical per week is specified.
- Approach to the assessment of student's learning and types of assessment techniques to be used were decided. An assessment scheme was designed which is suitable mix of (a) continuous evaluation of term-work (b) progressive test (c) Term end examination.
- Implementation strategies for each subject were identified.
- Learning resources for students were prescribed such as …….
  - Teacher's lecture notes.
  - Basic text-book covering most of the topics in the curriculum and other books.

- Monographs, handbooks, periodicals, articles, journals etc.
- Data-books, manuals, standards etc.
- Various websites (internet)

In all these activities, views of senior teachers regarding relevance of course contents and implementation strategies being presently followed are sought.

An Approach to Curriculum Design and Development Based upon Outcome Based Education (OBE) Philosophy as adopted for Sixth Revision of Curriculum of Government Polytechnic Aurangabad .

Introduction:

After conferring academic autonomy to Government Polytechnics during Second Technician World Bank Assisted Project (Tech Ed II) implemented from 1992 to 1999 the curriculum revision process is being carried out after every 4-5 years. Our Institute, being Academically Autonomous since 1994, has been following the same practice and hence this sixth revision of curriculum for all programmes.

Curriculum, as per Colombo Plan Staff College Manila (1984), means ***'an educational programme designed, developed and implemented to attain predetermined educational objectives.'*** Therefore curriculum ought to be designed for achieving purpose, objectives, outcomes that are decided well in advance. More over curriculum at any level, let it be at unit, at course, at course category or at programme level at the top, comprises of (Ralph Tylor 1949) rationale, objectives/ outcomes, content, Learning -Teaching strategies (LTS) and finally student's assessment and evaluation.

We are in the era where technical manpower in general and engineering technicians in particular are required to solve or assist in solving engineering problems from nano – micro level to mega level (Jeff Lohmann 2009). It is expected from him/ her in that case to use knowledge of not only technology but also natural sciences (animate, inanimate and psycho socio sciences) and mathematics. Moreover he/ she is required to use advance IT based tools and techniques in diagnosing faults and carry out maintenance. Further technical manpower should have ability to work in team, communicate effectively, and remain updated of technologies they are expected to deal with.

As per research on curriculum in engineering and technology, education carried out in different parts of world it is concluded that philosophy, framework, approach and model that is to be used for developing technical manpower with such profile should be Interdisciplinary – integrated curriculum.

Therefore the philosophy of curriculum development used in revising sixth curriculum has been Integrated – interdisciplinary in nature to achieve outcome based technical education .

Even though all prevailing & necessary apt theories of curriculum design are used in the curriculum development process the existing curriculum has been questioned for its ability to provide clearly stated learning outcomes and therefore it is right time that the revised curricula requires that it should give enough clarity as regards intended learning outcomes to all concerned – first to the student, then to the teachers and the industry, followed by all the other stakeholders. This meant that the curriculum should explicitly state as to what are the observable and measurable 'competencies' expected by the industry. Such 'competencies' comprising of measurable 'Course outcomes' in the 'cognitive domain', measureable associated practical outcomes in the form of practical exercises in the 'psychomotor domain' and measurable social skills related to the 'affective domain' will help the students and teachers in knowing the 'length, breadth and depth' of the course necessary to achieve the competency.

Therefore Curriculum need to be outcome-based where competencies / program outcomes and course outcomes are measurable.

We are in the era of accords viz. Washington, Sidney, Dublin Accords in which gradation of any engineering and technology programme is carried out using outcome based criteria in signatory countries. It was the outcome based criteria, which was devised for the first time by Accreditation Board for Engineering and Technology (ABET), that is being followed in USA for grading programmes for their quality since 1998. It is the industry which made educational institutes to go for outcome based criteria popularly known as EC 2000 where main emphasis is over outcomes – what he/ she knows and what he/ she is able to do.

National Board of Accreditation (NBA) has been practicing outcome based criteria in grading educational programmes of institutes awarding diploma and degree in engineering and technology. In that case the board empowered to undertake exercise of accrediting programmes has developed indigenous criteria for diploma programmes as follows: -

i. Vision, mission and programme educational objectives

ii. Programme outcomes
iii. Programme curriculum
iv. Students performance
v. Faculty
vi. Facilities and technical support
vii. Academic support unit and teaching learning process
viii. Governance
ix. Institutional support and finance resources
x. Continuous improvement

As All India Council for Technical Education (AICTE) has made it mandatory to institutions to follow curricular processes for extending Outcome Based Technical Education and get programme accreditated from NBA.

Philosophy for Sixth Revision of Curriculum adopted at Government Polytechnic Aurangabad :

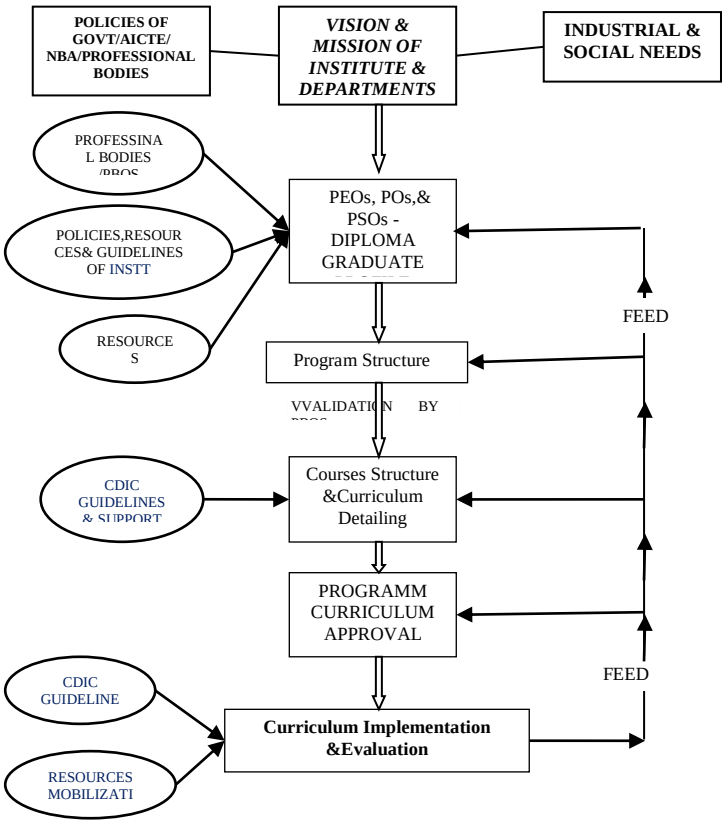
Sixth revision of Curriculum uses model, approach, philosophy evolved over the years in other part of the world and accepted by our nation through National Board of Accreditation (NBA). being signatory of Washington Accord. It is the curriculum development philosophy that will enable institutes to impart Outcome based education (OBE). It is essential in that case to design a programme curriculum, develop resources for implementing it, implement it and undertake student's assessment and evaluation to impart OBE.

As regards, sixth revision of curriculum, which is based primarily on Outcome Based Education philosophy, follows the following stages.

1. Occupation analysis.
2. Formulation of Vision & Mission of Institute/Department.
3. Formulation of Diploma graduate attributes and Programme Educational Objectives.
4. Evolve Program Structure.
5. Evolve Course structure, Course Competencies, Course Outcomes & Curriculum detailing of each course.
6. Approval of Curriculum
7. Implementation of Curriculum.

Approach to Curriculum Design and Development for Sixth Revision of Curriculum based upon above stages has been elaborated and depicted schematically as below.

In line with above stages, the institute ,under the guidance of NITTTR Bhopal organized the search conference/workshop involving industry personnel from several industries in the region covering all sectors related to 8 programmes run in the institute .



CURRICULUM DEVELOPMENT APPROACH

.

This led to occupation analysis, knowing industry and society expectations as regards diploma graduate / engineer to arrive at profile of diploma engineers.

Institute also carried meetings and deliberations with stake holders to formulate the renewed Vision & Mission of Institute and departments as well. The Vision & Mission so formulated have been considered as the terms of references in curriculum revision process.

Programme Educational Objectives (PEOs) – Programme educational objectives which are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to achieve are formulated.

Programme Outcomes (POs) - As Mandated by NBA, following Programme Outcomes have been also the basis for curriculum revision. These Programme outcomes state the attainment of students' abilities, which the Department has to ensure that the stated outcomes are achieved before they are allowed to graduate.

1. Basic knowledge: An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.
2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.
3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.
4. Engineering Tools: Apply appropriate technologies and tools with an understanding of the limitations.
5. The engineer and society: Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
6. Environment and sustainability: Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
7. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the 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 the preparation and ability to engage in independent and life-long learning in the context of technological changes.

In the next stage following steps have been followed

xi. Identification & validation of Programme Structure
xii. Validation of programme structure
xiii. Detailing of course curricula
xiv. Vetting of programme curriculum
xv. Implementation and student's evaluation

Under the guidance of Programme wise Board of Studies (PBOS) , Course areas, levels, programme structure are worked and validated. In line with this structure, course structure, Teaching & Examination schemes are formulated. For each course, course rationale, course competency, course outcomes, content detailing, specification table, practical experiences along with instructional strategies/methods & student activities are also identified and validated by the PBOS.

Curricula of respective programme are presented before Board of Studies (BOS) for the final approval before it is implemented.

Implementation of curriculum involves, orienting faculty & staff for implementation, development lab manuals, learning resources , model question papers and training faculty for expertise in course areas (if required).

Mapping – Mapping is the process of representing, preferably in matrix form, the correlation among the parameters. It may be done for one to many, many to one, and many to many parameters. In curriculum development process COs are mapped with POs & PSOs to establish the correlation between COs & POs/PSOs.

Salient Features of Curriculum:

Curriculum of each programme comprises of 40 -45 courses with 194 credits at five levels viz. foundation courses, basic technology courses, allied courses, applied technology courses and diversified technology courses to be taught over three years of any diploma programme offered. It is outcomes at five tiers viz. International & Professional (after 3—5 years of graduation) registration, programme outcomes, course outcomes and major learning outcome of each unit are used to establish not only intra course and inter courses integration but also the programme outcome is getting linked to international and professional registration of diploma graduates.

The levels as stated above are defined as follows:

xvi. Foundation – This course level contains courses that remains foundation to learn not only basic technology but also technology courses of advance and diversified levels. Natural sciences and Mathematics (NS&M) are the subject areas from which these courses are designed.

xvii. Basic Technology - This level represents set of courses that are derived from foundation courses. These courses link foundation courses with applied and diversified technology courses.

xviii. Allied - The courses related to Humanities and Social Sciences (H&SS) are a part of this level. They play a role of developing anD human and social dimensions of personality of engineers.

xix. Applied technology - This level contains courses related to title of the programme viz. Civil engineering, Mechanical engineering etc. Every programme represents a sector of an economy and it prepares manpower that deals with design, production, and maintenance of entities related to the programme i.e. Civil engineering deals with building, roads, and automobile engineering related to motor vehicles as the entities

xx. Diversified technology - This is fifth level of curriculum in which types of courses are from diversified technology are included. This level exposes students to latest development in the field of study.

PROGRAMME OUTCOMES (PO)

PO1. **Basic knowledge (Building foundation) :** Apply knowledge of basic mathematics, science and engineering to solve the Mechanical Engineering related problems.

PO2. **Discipline knowledge (Disc. Specific knowledge):** Apply discipline - specific knowledge to solve core and/or applied problems.

PO3. **Experiments and practice (Hands on experience):** Plan to perform experiments and practices and to use the results to solve problems.

PO4. **Engineering tools (Tools and Technology):** Apply appropriate technologies and tools with an understanding of the limitations

PO5. **The engineer and society (societal needs):** Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Mechanical Engineering.

PO6. **Environment and sustainability (Sustainability and env. Concern):** Apply engineering solutions for sustainable development practices in societal and environmental contexts.

PO7. **Ethics (Morale and ethics) :**Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice in field of Mechanical Engineering.

PO8. **Individual and team work (Team building) :** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

PO9. **Communication:** Communicate effectively in oral and written form.

PO10. **Life-long learning (Continuing education):** Engage in independent and life-long learning in the context of technological changes.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOS)

PEO 1: Provide students with the fundamental technical knowledge and skills in science, and engineering, and to apply these abilities to implement solutions in practice.

PEO 2: Provide students with necessary instructional and practical experience to work effectively in local and international environments and to become effective communicators.

PEO 3: To provide an academic environment that gives adequate opportunity to the students to cultivate lifelong skills needed for a successful professional career.

PEO 4: To inculcate professional and ethical attitude, team work, multidisciplinary approach, entrepreneurial thinking and an ability to relate Mechanical Engineering issues with social issues.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1. **Modern Software Usage:** Use latest software and innovations in the area of Mechanical Engineering.

PSO2.**Manage Manufacturing Process:** Manage the Manufacturing process by selection and scheduling right type of machinery, equipment, substrates and Softwares for a particular job for economy of operations.

MAPPING OF MISSION AND PROGRAMME EDUCATIONAL OBJECTIVES

PEO Statements	M1	M2	M3	M4
PEO1: Provide students with the fundamental technical knowledge and skills in science, and engineering, and to apply these abilities to implement solutions in practice	3	1	2	1
PEO 2: Provide students with the necessary instructional and practical experience to work effectively in local and international environments and to become effective communicators, mentor.	2	2	3	1
PEO 3: To provide an academic environment that gives adequate opportunity to the students to cultivate lifelong skills needed for a successful professional career.	2	3	1	-
PEO 4: To inculcate professional and ethical attitude, team work, multidisciplinary approach, entrepreneurial thinking and an ability to relate Mechanical Engineering issues with social issues.	1	1	-	3

MISSION

M1: Development of competent students for employability and entrepreneurship.
M2: To encourage students to participate in technical competitions.
M3: Exposure to the industrial practices.
M4: To create a sense of social and environmental concern by inculcating humanitarian and ethical responsibilities.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES AND PROGRAMME OUTCOMES

Sr. No.	Programme Educational Objectives (PEOs)	Programme Outcomes (POs)
1	**PEO 1:** Provide students with the fundamental technical knowledge and skills in science, and engineering, and to apply these abilities to implement solutions in practice.	PO1,PO2,PO3,PO4, PO10
2	**PEO 2:** Provide students with the necessary instructional and practical experience to work effectively in local and international environments and to become effective communicators, mentor.	PO4,PO6,PO9,PO10
3	**PEO 3:** To provide an academic environment that gives adequate opportunity to the students to cultivate lifelong skills needed for a successful professional career.	PO1,PO2,PO3,PO4,PO8 ,PO10,
4	**PEO 4:** To inculcate professional and ethical attitude, team work, multidisciplinary approach, entrepreneurial thinking and an ability to relate Mechanical Engineering issues with social issues.	PO5,PO6,PO7,PO8

MAPPING OF PROGRAMME OUTCOME AND COURSES

SR NO	PROGRAMME OUTCOMES	COURSES
	PO1. Basic knowledge (Building foundation): Apply knowledge of basic mathematics, science and engineering to solve the Mechanical Engineering related problems.	Basic Math, Engg. Chemistry, Refrigeration &Air conditioning,ToolEngg,Thermal,Engg,Engg.Graphics,WorkshopPractics,Basic of computers, English, Computer aided drafting, Computer integrated machining, Industrial Fludics, Measurement & Control, Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg, Environmental science, Engg. Math, Engg. physics,Communicationskills,Engg.Mechanics, EnggDrawing,MechnicalTechnology,Development of life skills, Enterpreneurship Development, Fluidpower, Mechanical Engg materials, Maching processes, Theory of machines, Strength of Materials, Basic Electrical & Electronics.
	PO2. Discipline knowledge (Disc. Specific knowledge): Apply discipline - specific knowledge to solve core and/or applied problems.	Basic Math, Engg. Chemistry, Refrigeration & Air-conditioning, Tool, Engg, Thermal, Engg, Engg. Graphics, Workshop Practices, Basic of computers, English, Computer aided drafting, Computer integrated machining, Industrial Fludics, Measurement & Control, Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg, Environmental science, Engg Math, Engg physics, Communication skills, Engg. Mechanics, Engg. Drawing, Mechanical Technology, Development of life skills,

		Entrepreneurship Development, Fluidpower, Mechanical Engg materials, Machining processes, Theory of machines, Strength of Materials, Basic Electrical & Electronics, Seminar.
	PO3. Experiments and practice (Hands on experience): Plan to perform experiments and practices and to use the results to solve problems.	Basic Math, Engg. Chemistry, Refrigeration & Air-conditioning, Tool, Engg, Thermal, Engg, Engg. Graphics, Workshop Practics, Basic of computers, English, Computer aided drafting, Computer integrated machining, Industrial Fludics, Measurement & Control , Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg, Environmental science, Engg Math, Engg physics, Communication skills, Engg. Mechanics, Engg Drawing, Mechanical Technology, Development of life skills, Fluid power, Mechanical Engg materials, Machining processes, Theory of machines, Strength of Materials, Basic Electrical &Electronics, Seminar.
	PO4. Engineering tools (Tools and Technology): Apply appropriate technologies and tools with an understanding of the limitations	Engg. Chemistry, Refrigeration & Air-conditioning, Tool, Engg, Thermal, Engg, Engg. Graphics, Workshop Practices, Basic of computers, English , Computer integrated machining, Industrial Fludics, Measurement & Power plant Engg. Control, Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg Engg Math, Engg physics, Communication skills, Engg. Mechanics, Engg Drawing, Mechanical Technology, Development of life skills, Entrepreneurship Development, Fluid power,

		Mechanical Engg materials Industrial Mgt. Maching processes, Theory of machines, Basic Electrical & Electronics, Seminar.
	PO5. The engineer and society (societal needs): Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Mechanical Engineering.	Engg. Chemistry, Refrigeration & Air conditioning, power plant engg. Computer aided drafting, Thermal, Engg, ,Workshop Practices, ,English, Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Engg Math, Communication skills, Development of life skills, Fluid power, Industrial Mgt.
	PO6. Environment and sustainability (Sustainability and env. Concern): Apply engineering solutions for sustainable development practices in societal and environmental contexts.	Engg. Chemistry, Refrigeration & Air-conditioning, Tool Engg, Thermal, Engg, English, Computer aided drafting, Industrial Fludics Automobile Engg, Advance manufacturing process, Heat power Engg, Environmental science, Engg physics, Communication skills, Mechanical Engg materials, Maching processes, Theory of machines.
	PO7. Ethics (Morale and ethics): Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice in field of Mechanical Engineering.	Refrigeration &Air conditioning, Thermal, Engg , English, workshop practices, communication, Computer integrated machining, skills, Development of life skills, entrepreneurship development, Computer aided drafting, Automobile Engg, Advance manufacturing process, Heat power Engg, Engg physics, Basic Electrical & Electronics, Theory of machines. Mechanical Engg drawing. Power plant engg.
	PO8. Individual and team work (Team building) : Function effectively as a leader and team member in	Refrigeration &Air conditioning, Thermal, Engg, Workshop Practices, English, Computer aided drafting, Computer integrated machining,

	diverse/ multidisciplinary teams.	Industrial Fludics Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg, Communication skills, Engg Drawing, Mechanical Technology, Development of life skills, Fluidpower, Basic Electrical & Electronics, Seminar.
	PO9. Communication: Communicate effectively in oral and written form.	Refrigeration & Air conditioning, Thermal, Engg, Engg. Graphics, Workshop Practices, English, Computer aided drafting, Computer integrated machining, Industrial Fludics, Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg, Environmental science, Communication skills , Engg Drawing, Development of life skills, Theory of machines, Basic Electrical & Electronics.
	PO10. Life-long learning (Continuing education): Engage in independent and life-long learning in the context of technological changes.	Refrigeration & Air conditioning, Tool, Engg, Thermal, Engg, Engg. Graphics, Workshop Practices, Basic of computers, English, Computer aided drafting, Computer integrated machining, Industrial Fludics, Mechanical Engg drawing, Automobile Engg, Advance manufacturing process, Heat power Engg, Engg Math, Engg physics, Communication skills , Development of life skills, Mechanical Engg materials, Basic Electrical & Electronics

PROGRAMME STRUCTURE AT A GLANCE

SR. NO	LEVELS	COMPULSORY COURCES	OPTIONAL COURSES	CREDITS COMP. + OPTIONAL	MARKING SCHEME		
					COMPULSORY COURSES	OPTIONAL COURSES	TOTAL
1	Foundation	4	--	18	500	--	500
2	Basic	13	--	63	1575	-	1575
3	Allied	6	02/15	24	475	--	475
4	Applied	10	01/3	57	1300	150	1450
5	Diversified	6	01/3	32	750	150	900
	TOTAL	39	4	194	4600	300	4900

Scheme at a glance:

Total number of courses offered : 60

Number of Compulsory courses : 39

Number of Optional course : 25

Total courses to be applied : 43

LEVELWISE COURSE STRUCTURE

Level 1: Foundation Level Courses:

	FOUNDATION LEVEL											
Sr. No.	**Course Code**	**Course Name**	**Teaching Scheme**					**Examination Scheme**				
			Th	**Pr**	**Tu**	**Cr**	**Term**	**PT**	**Th**	**Pr**	**Tw**	**Or**	**Total**
1	6G101	Basic Mathematics (BMT)	3	--	1	4	I	20	80	--	--	--	100
2	6G102	Engineering Mathematics (EMT)	3	--	1	4	II	20	80	--	--	--	100
3	6G103	Engineering Physics (EPH)	3	2	--	5	II	20~	80~	25@	25	--	150
4	6G104	Engineering Chemistry (ECH)	3	2	--	5	I	20~	80~	25@	25	--	150
			12	**04**	**02**	**18**		**80**	**320**	**50**	**50**	**--**	**500**

Scheme at Glance:

Total number of courses offered : 04
Number of Compulsory Courses : 04
Number of Optional Courses : Nil
Total Courses : 04
Total Credits : **18**
Total Marks : 500

Tu = Tutorial

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
M- COURSES FOR MECHANICAL ONLY.

Level 2: Basic Technology Courses

Sr. No	Course Code	Course Name	Teaching Scheme					Examination Scheme					
			Th	Pr	Tu	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	6G201	Engineering Graphics	2	2	--	4	I	--	--	50@	50	--	100
2	6R201	Engineering Drawing	2	4	--	6	II	--	--	50#	50	--	100
3	6Q201	Engineering Mechanics	4	2	--	6	II	20	80	--	25	--	125
4	6G202	Work Shop Practice	0	3	--	3	I	--	--	--	50	--	50
5	6R202	Strength Of Materials	3	2	--	5	III	20	80	--	50	--	150
6	6M202	Machining Processes	2	4	--	6	III	20	80	50#	50	--	200
7	6G203	Basics of Computer System	--	2	--	2	I	--	--	25@	25	--	50
8	6R203	Basics of Electrical Engineering and Electronics	4	2	--	6	IV	20	80	--	50	--	150
9	6M204	Mechanical Technology	3	3	--	6	II	20	80	--	50	--	150
10	6M205	Thermal Engineering	3	2	--	5	IV	20	80	--	25	25#	150
11	6M206	Theory of Machines	3	2	--	5	III	20	80	--	50	--	150
12	6M207	Measurement & Controls	3	2	1	6	IV	20	80	--	25	25#	150
13	6M208	Computer aided Drafting	1	2	-	3	IV	-	-	25@	25	-	50
								160	**640**	**200**	**525**	**50**	
			30	**32**	**1**	**63**		**800**			**775**		**1575**

Scheme at Glance:

Total number of courses offered : 13
Number of Compulsory Courses : 13
Number of Optional Courses : Nil
Total Courses : 13
Total Credits : **63**
Total Marks : 1575

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
M- COURSES FOR MECHANICAL ONLY

Level 3: Allied Level Courses

Sr. No.	Course Code	Course Name	Teaching Scheme					Examination Scheme					
			Th	Pr	Tu	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	6G301	English	2	2	--	4	I	20	80	--	25	--	125
2	6G302	Communication Skills	1	2	--	3	II	--	--	--	50	25@	75
3	6G303	Development of Life Skills	--	2	--	2	III	--	--	--	25	25@	50
4	6G304	Environmental Science	--	2	--	2	I	--	--	--	50	--	50
5	6G305	Industrial Organization & Management	3	2	--	5	V	20	80	--	25	--	125
6	6G306	Entrepreneurship Development	2	2	--	4	III	--	--	--	50	--	50
7	6G311-6G325	Non-Exam(Elective-I)	--	2	--	2	II	--	--	--	--	--	--
8	6G311-6G325	Non-Exam(Elective-I)	--	2	--	2	III	--	--	--	--	--	--
								40	**160**	**-**	**225**	**50**	
			8	**16**	**--**	**24**		**200**		**275**			**475**

Nmbik7mScheme at Glance:

Total number of courses offered : 8
Number of Compulsory Courses : 6
Number of Optional Courses : 2 (15)
Total Courses : 8
Total Credits : **24**
Total Marks : 475

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
M- COURSES FOR MECHANICAL ONLY

Level 4: Applied Level Courses

Sr. No	Course Code	Course Name	Teaching Scheme					Examination Scheme					
			Th	Pr	Tu	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	6M401	Fluid Mechanics and Machinery	3	2	--	5	III	20	80	--	25	25#	150
2	6M402	Industrial Fluid Power	3	2	--	5	IV	20	80	--	25	--	125
3	6M403	Machine Drawing	2	4	--	6	IV	20	80	--	25	25#	150
4	6M404	Heat Power Engineering	3	2	-	5	V	20	80	--	25	25#	150
5	6M405	3-D Modeling	1	2	--	3	V	--	--	25#	50	--	75
6	6M406	Computer Integrated Machining	2	2	--	4	IV	--	--	--	25	25#	50
7	6M407	IC Engines	4	2	--	6	VI	20	80	--	25	25#	150
8	6M408	Advanced Manufacturing Processes	3	4	--	7	VI	20	80	--	25	25#	150
9	6M409	Tool Engineering	3	2	--	5	V	20	80	--	25	25#	150
10	6M410	Mechanical Engineering Materials	3	2	--	5	III	20	80	--	25	25#	150
ELECTIVE-II													
Sr. No	**Course Code**	**Course Name**		**Teaching Scheme**				**Examination Scheme**					
			Th	**Pr**	**Tu**	**Cr**	**Term**	**PT**	**Th**	**Pr**	**Tw**	**Or**	**Total**
		GROUP A (Any 1)											
1	6M411	Power plant Engineering	4	2	-	6	V	20	80	--	25	25#	150
2	6M412	Refrigeration and Air-conditioning	4	2	-	6	V	20	80	--	25	25#	150
3	6M413	Automobile Engineering	4	2	-	6	V	20	80	--	25	25#	150
			31	**26**	**-**	**57**		**900**		**550**			**1450**

Scheme at Glance:

Total number of courses offered : 11
Number of Compulsory Courses : 10
Number of Optional Courses : 1(3)
Total Courses : 11
Total Credits : **57**
Total Marks : 1450

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
M-COURSES FOR MECHANICAL ONLY

Level: 5 Diversified Level Courses

Sr.N	Course Code	Course Name	Teaching Scheme					Examination Scheme					
			Th	Pr	Tu	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	6M501	Seminar	--	2	--	2	V	--	--	--	25	50@	75
2	6M502	Project	--	4	--	4	VI	--	--	--	100	50#	150
3	6M503	Vocational Training	--	4	--	4	VI	--	--	--	50	50#	100
4	6M504	Design of Machine Elements	4	2	--	6	V	20	80	--	25	25#	150
5	6M505	Metrology and Quality Control	3	2	--	5	VI	20	80	25#	25	--	150
6	6M506	Production Engineering	3	2	--	5	VI	20	80	--	25	--	125
ELECTIVE-III													
Sr.N	**Course Code**	**Course Name**	**Teaching Scheme**					**Examination Scheme**					
		GROUP B (Any one)	**Th**	**Pr**	**Tu**	**Cr**	**Term**	**PT**	**Th**	**Pr**	**Tw**	**Or**	**Total**
1	6M507	Advance Manufacturing Systems	4	2	--	6	VI	20	80	-	25	25#	150
2	6M508	Alternative Energy Sources	4	2	--	6	VI	20	80	-	25	25#	150
3	6M509	Production Planning & control	4	2	--	6	VI	20	80	-	25	25#	150
			14	**18**	--	**32**		**400**			**500**		**900**

Scheme at Glance:

Total number of courses offered : 7
Number of Compulsory Courses : 6
Number of Optional Courses : 1(3)
Total Courses : 7
Total Credits : 32
Total Marks : 900

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
M- COURSES FOR MECHANICAL ONLY.

(LIST OF NON EXAM COURSES)

COURSE CODE	COURSE TITLE	TEACHING SCHEME				EXAMINATION SCHEME					
		TH	PR	CR	TERM	PT	TH	PR	TW	OR	TOTAL
6G311	Personality Development	-	02	02							
6G312	Fashion Accessories	-	02	02							
6G313	Hobby Electronics	-	02	02							
6G314	Spoken English	-	02	02							
6G315	German	-	02	02							
6G316	French	-	02	02							
6G317	Yoga	-	02	02							
6G318	Music instrumental	-	02	02							
6G319	Two wheeler maintenance	-	02	02							
6G320	Entrepreneurship Development(EE)	-	02	02							
6G321	Electrical maintenance	-	02	02							
6G322	Electronic maintenance	-	02	02							
6G323	Computer Hardware Maintenance										
6G324	Japanese	-	02	02							
6G325	Music vocal	-	02	02							
6G326	aerobics	-	02	02							
6G327	Indian classical Dance	-	02	02							
6G328	Sewing machine maintenance	-	02	02							

Sample Path (X Class Entry) (With In plant Training)

Year – I		Year - II		Year - III	
ODD Sem.	EVEN Sem.	ODD Sem.	EVEN Sem.	ODD Sem.	EVEN Sem.
Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)
Workshop Practice 6G202 (0+3)	Engineering Physics 6G103 (3+2)	Theory of Machines 6M206 (3+2)	Computer Integrated Machining 6M406 (2+2)	Heat Power Engg 6M404 (3+2)	Production Engg 6M506 (3+2)
Basic Mathematics 6G101 (3+1T)	Engineering Mechanics 6Q201 (4+2)	Fluid Mechanics & machinery 6M401 (3+2)	Thermal Engg 6M205 (3+2)	Design of m/c Element 6M504 (4+2)	Advance Mfg Processes 6M408 (3+4)
ENGINEERING CHEMISTRY 6G104 (3+2)	Engineering Mathematics 6G102 (3+1T)	Machining Processes 6M202 (2+4)	Machine Drawing 6M403 (2+4)	Tool Engg 6M409 (3+2)	PROJECT 6M502 (0+4)
Engineering Graphics 6G201 (2+2)	Communication Skills 6G302 (1+2)	Mechanical Engineering. Materials 6M410 (3+2)	Measurement & Control 6M207 (3+2+1T)	Elective II 6M411-413 (Any one) (4+2)	Elective III 6M507-509 (Any one) (4+2)
Basics of Computer System 6G203 (0+2)	Engineering Drawing 6R201 (2+4)	Entrepreneurship Development 6G306 (2+2)	Basics of Electrical Engg and Electronics 6R203 (4+2)	3 D Modeling 6M405 (1+2)	Metrology and Quality Control 6M505 (3+2)
English 6G301 (2+2)	Elective I Non exam 6G311-6G325 (0+2)	Development of Life Skills 6G303 (0+2)	Industrial Fluid Power (6M402) (3+2)	Seminar 6M501 (0+2)	I.C.Engines 6M407 (4+2)
Environmental Science 6G304 (0+2)	Mechanical Technology 6M204 (3+3)	Non Exam 6G311-6G325 (0+2)	Computer Aided Drafting 6M208 (1+2)	Industrial Organization & Management 6G305 (3+2)	Vocational Training 6M503 (0 + 4)
		Strength of Material 6R202 (3+2)			
24	32	34	35	32	37
Total Credits	194				

Sample Path for DSY students

Year – I		Year - II		Year - III	
ODD Sem.	EVEN Sem.	ODD Sem.	EVEN Sem.	ODD Sem.	EVEN Sem.
Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)	Course Code Course Title Credits (Th+Pr)
		Theory of Machines 6M206 (3+2)	Computer Integrated Machining 6M406 (2+2)	Heat Power Engineering 6M404 (3+2+1T)	Production Engineering 6M506 (3+2)
		Fluid Mechanics & machinery 6M401 (3+2)	Thermal Engineering 6M205 (3+2)	Design of m/c Element 6M504 (4+2)	Advance Mfg Processes 6M408 (3+4)
		Machining Processes 6R202 (2+4)	Machine Drawing 6M403 (2+4)	Tool Engineering 6M409 (3+2)	PROJECT 6M502 (0+4)
		Mechanical Engineering Materials. 6M410 (3+2)	Measurement & Control 6M207 (3+2+1T)	Elective II 6M411-413 (Any one) (4+2)	Elective III 6M507-509 (Any one) (4+2)
		Entrepreneurship Development 6G306 (2+2)	Basics of Electrical Engg and Electronics 6R203 (4+2)	3 D Modeling 6M405 (1+2)	Metrology and Quality Control 6M505 (3+2)
		Development of Life Skills 6G303 (0+2)	Industrial Fluid Power (6M402) (2+2)	Seminar 6M501 (0+2)	I.C.Engines 6M407 (4+2)
	Elective I Non Exam 6G311-6G325 (0+2)	Elective I Non Exam 6G311-6G325 (0+2)	Computer Aided Drafting 6M208 (1+2)	Industrial Organization & Management 6G305 (3+2)	Vocational Training 6M503 (0 + 4)
		Strength of Material 6M202 (3+2)			
24	32	34	34	33	37
Total Credits	194				

SAMPLE PATH FOR PTD(PART TIME DIPLOMA)

Year - I		Year - II		Year - III		YEAR - IV	
ODD Sem.	**EVEN Sem.**	**ODD Sem.**	**EVEN Sem.**	**ODD Sem.**	**EVEN Sem.**	**ODD**	**EVEN**
Course Title Credits (Th+Pr)	**Course Title Credits (Th+Pr)**	**Course Title Credits (Th+Pr)**	**Course Title Credits (Th+Pr)**	**Course Title Credits (Th+Pr)**	**Course Title Credits (Th+Pr)**	**Course Title Credits (Th+Pr)**	**Course Title Credits (Th+Pr)**
Basic. Mathematics (6G101) (3+1T)	Engineering Physics (6G103) (3+2)	Theory of Machines (6M206) (3+2)	Thermal Engg (6M205) (3+2)	Machine Drawing (6M403) (2+4)	Design of m/c Element (6M504) (4+2)	Tool Engineering (6M409) (3+2)	Elective-III(6M507 TO 6M509) (4+2)
ENGINEERING CHEMISTRY (6G104) (3+2)	Entrepreneurship Development (6G306) (2+2)	Engg. Drawing (6R201) (2+4)	Basics of Electrical Engg and Etx (6R203) (4+2)	Development of Life Skills (6G303) (0+2)	Advanced Manufactu-ring Processes (6M408) (3+4)	Elective-II (6M411-413) (4+2)	MQC (6M505) (3+2)
Engineering Graphics (6G201) (2+2)	Engineering Mathematics (6G102) (3+1T)	Environmental science (6G304) (0+2)	SOM (6R202) (3+2)	Measurement and Control (6M207) (3+1T+2)	Computer Integrated Machining (6M406) (2+2)	Seminar (6M501) (0+2)	IC Engines (6M407) (4+2).
Basics of Computer System (6G203) (0+2)	Communication Skills (6G302) (1+2)	Engineering Mechanics (6Q201) (4+2)	Machining Processes (6M202) (2+4)	Fluid Mechanics & Machinery(6M401) (3+2)	Industrial Organization &Management (6G305) (3+2)	Production Engineering (6M506) (3+2)	Project (6M502) (0+4)
English (6G301) (2+2)	Mechanical Technology (6M204) (3+3)	MEM (6M410) (3+2)	Computer Aided Drafting (6M208) (1+2)	Heat power Engg (6M404) (3+2)	Industrial Fluid Power (6M402) (3+2)	3 D Modeling (6M405) (1+2)	
19	22	24	25	24	27	21	21
Total Credits							183

Exemptions: WP (0+3) +(Elective I) NON EXAM (0+4) +Vocational Training (0+4)

TOTAL CREDITS EXEMPTED = 11

MECHANICAL ENGINEERING DEPARTMENT
SEMESTERWISE COURSES

FIRST SEMESTER

Course Code	Course Name	Teaching Scheme/Credits				Examination Scheme (Maximum Marks)						
		TH	PR	Tu	Total Credit	PT	TH	PR	OR	PA (TW)	Total	TH EXAM HR
6G101	Basic Mathematics	3	-	1	4	20	80	-	-	-	100	3
6G104	Engineering Chemistry	3	2	-	5	20~	80~	25@	-	25	150	3
6G201	Engineering Graphics	2	2	-	4	-	-	50@	-	50	100	-
6G202	Workshop Practice	-	3	-	3	-	-	-	-	50	50	-
6G203	Basics of Computer System	-	2	-	2	-	-	25@	-	25	50	-
6G301	English	2	2	-	4	20	80	-	-	25	125	3
6G304	Environmental Science	-	2	-	2	-	-	-	-	50	50	-
		10	13	1	24	60	240	100		225	625	

SECOND SEMESTER

Course Code	Course Name	Teaching Scheme/Credits				Examination Scheme (Maximum Marks)						
		TH	PR	TU	Total Credit	PT	TH	PR	OR	PA (TW)	Total	TH EXAM HR
6G102	Engineering Mathematics	3	-	1	4	20	80	-	-	-	100	3
6G103	Engineering Physics	3	2	-	5	20	80	25@	-	25	150	3
6Q201	Engineering Mechanics	4	2	-	6	20	80	-	-	25	125	3
6R201	Engineering Drawing	2	4	-	6	-	-	50#	-	50	100	-
6G302	Communication Skills	1	2	-	3	-	-	-	25@	50	75	-
6M204	Mechanical Technology	3	3	-	6	20	80	-		50	150	3
6G311-25	Non exam(Elective-I)	-	2	-	2	-	-	-	-	-	-	-
		16	15	1	32	80	320	75	25	200	700	

THIRD SEMESTER

Course Code	Course Name	Teaching Scheme/Credits				Examination Scheme (Maximum Marks)						
		TH	PR	TU	Total Credit	PT	TH	PR	OR	PA (TW)	Total	TH EXAM HR
6M206	Theory of Machines	3	2	-	5	20	80	-	-	50	150	3
6M401	Fluid Mechanics & Machinery	3	2	-	5	20	80	-	25#	25	150	3
6M202	Machining Processes	2	4	-	6	20	80	50#	-	50	200	3
6M410	Mechanical Engineering Materials	3	2	-	5	20	80	-	25#	25	150	3
6G306	Entrepreneurship Development	2	2	-	4	-	-	-	-	50	50	-
6G303	Development of Life Skills	-	2	-	2	-	-	-	25@	25	50	-
6R202	Strength of materials	3	2	-	5	20	80	-	-	50	150	3
6G311 - 25	Non Exam(Elective-I)	-	2	-	2	-	-	-	-	-	-	-
		16	18	-	34	100	400	50	75	275	900	

FOURTH SEMESTER

Course Code	Course Name	Teaching Scheme/Credits				Examination Scheme (Maximum Marks)						
		TH	PR	TU	Total Credit	PT	TH	PR	OR	PA (TW)	Total	TH EXAM HR
6M406	Computer Integrated Machining	2	2	-	4	-	-	-	25#	25	50	-
6M205	Thermal Engineering	3	2	-	5	20	80	-	25#	25	150	3
6M403	Machine Drawing	2	4	-	6	20	80	-	25#	25	150	4
6M207	Measurement & Control	3	2	1	6	20	80	-	25#	25	150	3
6R203	Basics of Electrical Engineering and Electronics	4	2	-	6	20	80	-	-	50	150	3
6M402	Industrial Fluid Power	3	2	-	5	20	80	-	-	25	125	3
6M208	Computer Aided Drafting	1	2	-	3	-	-	25@		25	50	-
		18	16	1	35	100	400	25	100	200	825	

FIFTH SEMESTER

Course Code	Course Name	Teaching Scheme/Credits				Examination Scheme (Maximum Marks)						
		TH	PR	TU	Total Credit	PT	TH	PR	OR	PA (TW)	Total	Theory Exam Hours
6M404	Heat Power Engineering	3	2	-	5	20	80	-	25#	25	150	3
6M504	Design of m/c Element	4	2	-	6	20	80	-	25#	25	150	4
6M409	Tool Engineering	3	2		5	20	80	-	25#	25	150	3
6M411 -413	Elective II	4	2	-	6	20	80	-	25#	25	150	3
6M405	3 D Modeling	1	2	-	3	-	-	25#		50	75	-
6M501	Seminar	-	2	-	2	-	-	-	50 @	25	75	-
6G305	Industrial Organization & Management	3	2	-	5	20	80	-	-	25	125	3
		18	14	-	32	100	400	25	150	200	875	

SIXTH SEMESTER

Course Code	Course Name	Teaching Scheme/Credits				Examination Scheme (Maximum Marks)						
		TH	PR	TU	Total Credit	PT	TH	PR	OR	PA (TW)	Total	Theory Exam Hours
6M506	Production Engineering	3	2		5	20	80	-	-	25	125	3
6M408	Advance Manufacturing Processes	3	4	-	7	20	80	-	25#	25	150	3
6M502	Project	-	4	-	4	-	-	-	50#	100	150	
6M507 -509	Elective III	4	2	-	6	20	80	-	25#	25	150	3
6M505	Metrology and Quality Control	3	2		5	20	80	25#		25	150	3
6M407	I.C.Engines	4	2	-	6	20	80	-	25#	25	150	3
6M503	Vocational Training	0	4	-	4	-	-	-	50#	50	100	-
		17	20		37	100	400	25	175	275	975	

LIST OF DIPLOMA AWARDED COURSES

Sr. No	Course Code	Course Name	Teaching Scheme					Examination Scheme					
			Th	Pr	T	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	6M410	Mechanical Engineering Materials	3	2	-	5	III	20	80	0	25	25#	150
2	6M406	Computer Integrated Machining	2	2	-	4	IV	0	0	-	25	25#	50
3	6M502	Project	0	4	-	4	VI	0	0	0	100	50#	150
4	6M501	Seminar	0	2	-	2	V	0	0	0	25	50 @	75
5	6M408	Advanced Manufacturing Processes	3	4	-	7	VI	20	80	0	25	25#	150
6	6M404	Heat Power Engineering	3	2	-	5	V	20	80	0	25	25#	150
7	6M504	Design of Machine Elements	4	2	-	6	V	20	80	0	25	25#	150
8	6M505	Metrology &Quality Control.	3	2	-	5	VI	20	80	25#	25	0	150
9	6M409	Tool Engg	3	2		5	V	20	80	0	25	25#	150
10	6M407	IC Engines	4	2	-	6	VI	20	80	0	25	25#	150
11	6M411-13	Elective Group II	4	2	-	6	V	20	80	0	25	25#	150
12	6M507-509	Elective Group III	4	2	-	6	VI	20	80	0	25	25#	150
13	6M405	3-D Modeling	1	2	-	3	V	0	0	25#	50	0	75
		Total Credits	34	30	-	64		180	720	50	425	325	1700

SIXTH REVISION OF CURRICULUM (OBE)

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME - YEAR 2017-18

INDEX

COURSE TITLE **WORKSHOP PRACTICE**

COURSE CODE **6G202**

Diploma Programme in which this course is offered	Semester in which offered
Common to all branches CE/ME/AE/EE/ET/IT/CO	First/Second

1. RATIONALE :

Workshop Practice is a basic engineering course. Diploma Engineers while working at worksites / in industries, supervises various skilled man power during industrial / site related process. He is required to be conversant with various skills. These basic skills are imparted in basic shops like wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides industrial environment in the educational institute.

2. COMPETENCY :

"Prepare simple jobs on the shop floor of the engineering workshop."

3. TEACHING AND EXAMNATION SCHEME :

Teaching Scheme (In Hours)			**Total Credits (L+T+P)**	**Examination Scheme**				
				Theory Marks		**Practical Marks**		**Total Marks**
L	T	P	C	ESE	PT	ESE(OR)	PA	
--	--	03	03	--	--	--	50	50

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES :

At the end of this course, students would be able to –

1. Select tools and machinery according to job.
2. Use hand tools in different shops for performing different operation.
3. Operate equipment and machinery in different shops.
4. Prepare job according to drawing.
5. Maintain workshop related tools, equipment and machineries.

5. DETAILED COURSE CONTENTS :

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I General Workshop Practice	1a. Follow safety practices. 1b. Explain the procedure for extinguishing fire 1c. Use firefighting equipment 1d. Locate various machines and equipment in workshop 1e. Follow good housekeeping.	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. 1.2 First Aid 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B,C, D, Firefighting equipment, fire extinguishers, and their types . 1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables.
Unit– II Fitting	2a. Identify fitting tools. 2b. Explain operation of fitting shop machines 2c. Use hand tools 2d. Operate machineries. 2e. Perform fitting operations 2f. Maintain tools, equipment and machineries.	2.1 Fitting hand tools bench vice, hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block , steel rule, twist drills, reamers, tap set, die set and their Specifications 2.2 Operation of fitting shops machineries - Drilling machine, Power saw, grinder their specifications and maintenance. 2.3 Basic process chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, dieing, reaming etc.
Unit– III Plumbing	3a. Identify plumbing tools. 3b. Explain operation of fitting shop machines 3c. Use hand tools 3d. Operate machineries. 3e. Perform plumbing operations 3f. Maintain tools, equipment and machineries.	3.1 Plumbing hand tools pipe vice, pipe bending equipment, pipe wrenches, dies and their Specifications 3.2 Pipe fittings- bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple and their Specifications 3.3 Operation of Machineries in plumbing shops- pipe bending machine their specifications and

		maintenance. 3.4 Basic process cutting, threading.
Unit– IV Metal Joining	4a. Identify metal joining tools. 4b. Explain gas and arc welding procedure 4c. Use hand tools. 4d. Perform welding, soldering, brazing operations 4e. Maintain tools, equipment and machineries.	4.1 Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter and their Specifications 4.2 Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthling clamp, wire brush and their Specifications 4.3 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance. 4.4 Welding Electrode, filler rod, fluxes, and solders. 4.5 Basic process welding, brazing and soldering.
Unit– V Furniture Making	5a. Select wood working tools as per job/ requirement. 5b. Explain operation of wood working machines 5c. Use hand tools 5d. Operate machineries. 5e. Perform wood working operations 5f. Maintain tools, equipment and machineries.	5.1 Types of artificial woods such as plywood, block board, hardboard, laminated boards, Veneer, fiber Boards and their applications. 5.2 Wood working hand tools carpentry vice, marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares, and their specifications 5.3 Operation of wood working machineries - Wood turning lathe, circular saw, their specifications and maintenance. 5.4 Basic process- marking, sawing, planning, chiseling, turning, grooving, boring.
Unit–VI Sheet Metal	6a. Identify sheet metal tools. 6b. Explain operation of sheet metal machineries. 6c. Use hand tools 6d. Operate sheet metal	6.1 Sheet metal hand tools snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set and their

	machineries. 6e. Perform bending operations 6f. Maintain tools, equipment and machineries.	Specifications 6.2 Operation of machineries in sheet metal shops- sheet cutting and bending machine their specifications and maintenance. 6.3 Basic process-marking, bending, folding, edging, seaming, staking, riveting.

6. **SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (Practical)**

Unit No.	**Unit Title**	**Teaching Hours**	**Distribution of Theory Marks**			
			R Level	**U Level**	**A Level**	**Total Marks**
I	General Workshop Practice	03	01	01	03	05
II	Fitting	12	-	03	06	09
III	Plumbing	06	-	02	07	09
IV	Metal Joining	09	01	02	06	09
V	Furniture Making	09	-	02	07	09
VI	Sheet Metal	09	-	02	07	09
	Total	48	02	12	36	50

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. **SUGGESTED EXERCISES/PRACTICALS :**

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs.required
1	I	Perform mock drill session in group of minimum 10 students for extinguishing fire.	03

2	II	Prepare job involving marking, punching, sawing, chamfering, drilling, tapping operations as per given drawing. (simple job individually)	09
3	III	Prepare plumbing job as per given drawing (individually)	06
4	III	Prepare black smithy job involving cutting, bending, drawing/ upsetting operations as per drawing (individually)	06
5	IV	Prepare lap joint/butt joint using arc welding as per given drawing (individually)	06
6	IV & V	Prepare utility job/ different working joints involving wood work as per given drawing (in group of 4 to 5 students)	12
7	VI	Prepare sheet cutting, bending, edging, end curling, lancing, soldering and riveting operations. (in group of 4 to 5 students)	06
Total			48

8. **SUGGESTED STUDENT ACTIVITIES :**

Following is the list of proposed student activities like:

1. Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be perform, required raw materials, tools, equipments, date of performance with teacher signature.
2. Prepare journals consist of free hand sketches of tools and equipments in each shop, detail specification and precautions to be observed while using tools and equipment.
3. Prepare/Download a specifications of followings:
    a) Various tools and equipment in various shops.
    b) Precision equipment in workshop
    c) Various machineries in workshop
4. Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
5. Visit any fabrication/wood working/sheet metal workshop and prepare a report.

9. **SPECIAL INSTRUCTIONAL STRATEGIES (if any) :**

1. Demonstration

10. **SUGGESTED LEARNING RESOURCES**

S.N.	Title of Book	Author	Publication
1.	Workshop Practice	Bawa, H.S.	McGraw Hill Education,Noida; ISBN-10: 0070671192 ISBN-13: 978-0070671195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.;Khurmi,R.S.	S.Chandand Co. New DelhiISBN:81-219-3092-8
3.	Workshop Practice Manual For Engineering Diploma & ITI Students	Hegde, R.K.	Sapna Book House, 2012, ISBN:13: 9798128005830
4.	Introduction to Basic Manufacturing Process & Workshop Technology	Singh, Rajender	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7

11. **Major Equipment/ Instrument with Broad Specifications**

S. No.	Equipment Name with Broad Specifications	Experiment S.No.
1	Fire buckets with stand of medium size	I, II, III, IV,V, VI
2	Fire extinguisher A,B and C types	I, II, III, IV,V, VI
3	Wood Turning Lathe Machine, Height of Centre: 200mm, Distance between Centers: 1200mm, Spindle Bore: 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive. with all accessories	II
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 45^0	II
5	Wood working tools- marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares,	II
6	Carpentry Vice 200 mm	II
7	Work Benches- size:1800 x 900 x 750 mm	III
8	Bench Drilling machine (up to 13 mm drill cap.) with ½ H.P. Motor	III

	1000 mm. Height.	
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	III
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	III
11	Vernier height Gauge 450 mm	III
12	Surface Plate 600 x 900 mm Grade I	III
13	Angle Plate 450 x 450 mm	III
14	Welding machine 20 KVA 400A welding current 300A at 50, 100, 200, 250, 300 with std. Accessories and Welding Cable 400 amp. ISI with holder	IV
15	Oxygen and acetylene gas welding and cutting kit with cylinders and regulators.	IV
16	Pipe Bending Machine	IV
17	Pipe Vice – 100 mm	IV
18	Pipe Cutter- 50 mm	IV
19	Bench Vice 100 mm	II,III,IV,V,VI
20	Portable Hammer Drill Machine 0-13 mm A.C. 230 V, 2.5Amp, Pistol type, having different types of bits	II, III, IV,V, VI
21	Sheet Bending Machine	VI
22	Sheet Cutting Machine	VI
23	Brazing Equipment	VI
24	Fitting tools - hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set.	III
25	Plumbing tools-pipe vice, pipe bending equipment, pipe wrenches dies.	IV
26	Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter	V
27	Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush.	V
28	Sheet metal hand tools-snip, shearssheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set	VI

12. E-learning recourses

(Please mention complete URL of the E- recourse CO wise)

1. http://www.asnu.com.au
2. http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf
3. http://www.weldingtechnology.org
4. http://www.newagepublishers.com/samplechapter/001469.pdf
5. http://www.youtube.com/watch?v=TeBX6cKKHWY
6. http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related
7. http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu
8. http://www.piehtoolco.com
9. http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/
10. https://www.youtube.com/watch?v=9_cnkaAbtCM

13. POs and PSOs assignment and its strength of assignment with each CO of the Course :

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO 1	Select tools and machinery according to job	1	2	3	3	1	-	1	2	2	2	2	-
CO 2	Use hand tools in different shop for performing different operation.	1	2	3	3	1	-	1	2	2	2	-	3
CO 3	Operate equipment and machinery in different shops	1	2	3	3	1	-	1	2	2	2	3	3
CO 4	Prepare job according to drawing	1	2	3	3	1	-	1	2	2	2	-	-
CO 5	Maintain workshop related tools, equipment and machineries	1	2	3	3	1	-	1	2	2	2	3	-

COURSE CURRICULUM DEVELOPMENT COMMITTEE :

Sr. No.	Name of the faculty members	Designation and Institute
1	D.V.Tammewar	Workshop Superitendent
2	Dr.U.V.Pise	Head of Mechanical Engineering

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE BASIC MATHEMATICS

COURSE CODE 6G101

Diploma Programme in which this course is offered	Semester in which offered
CE/ME/EE/ET/IT/CO/AE	First Semester

1. RATIONALE :

This course is classified under foundation level courses and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analise engineering problems. Diploma engineers have to solve the problems in engineering.
Basic mathematics is an attempt to initiate the multi-dimensional logical thinking and reasoning capabilities of the students.

2. COMPETENCY :

At the end of studying this course students will be able to
"**Solve engineering problems by using analytical and systematic approach.**"

3. COURSE OUTCOMES :

Students will be able to Apply rules of Logarithms in solving simple engineering problems

1. Solve simultaneous equations using concepts of Determinants and Matrices
2. Solve simple engineering problems using concepts of Partial Fractions
3. Solve simple engineering problems by applying formulae of trigonometry.
4. Solve simple engineering problem of function using the different definition of Function
5. Solve simple engineering problem of function using the rules of Limits.

4. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE	PA	
03	01	--	04	80	20	--	--	100
Exam Duration				03 Hrs.	01 Hr.			

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

5. COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit- I Revision	1a.To recall/know the basic concept of Logarithms and Determinant of order 2and3	1.1 Logarithms 1.2 Definition natural and common logarithms. 1.3 Laws of logarithm. 1.4Definition of Determinant, Order of Determinant. 1.5 Expansion of Determinant of order 2 and 3. 1.6 Properties of Determinant.
Unit- II Determinant And Matrices	2a.Students will be able to Solve simultaneous equations using concepts of Determinants and Matrices	2.1 Cramer's Rule. (solution of simultaneous equations in two and three unknowns) 2.1 Definition of matrix: Type of matrix: viz.- null, row, column, Square, diagonal, scalar, unit, Triangular. 2.2 Algebra of matrices –addition, subtraction and multiplication . 2.3 Transpose of a matrix. 2.4 adjoint of a matrix Relation. 2.5 Inverse of matrix by adjoint method. 2.6 Solution of simultaneous equations in two and three Unknowns using Inverse of matrix method .
Unit- III Partial Fractions	3a.Students will be able to solve simple problems Using concepts of Partial Fractions	3.1 Definition of Partial fraction, proper and improper fractions, rational fractions. 3.2 To resolve given rational fraction into partial fractions. 3.3 Denominator containing non repeated linear factors. 3.4 Denominator containing repeated linear factors. 3.5 Denominator containing irreducible non-repeated quadratic factors. 3.6 Different types of examples.
Unit- IV Trigonometry	4a.Students will be able to Solve simple problems by applying using concepts of	4.1 Trigonometric ratios of allied, compound and multiple angles. 4.2 Trigonometric Ratios of allied angles. 4.3 Trigonometric Ratios of compound angles.

	trigonometry.	4.4 Trigonometric Ratios of multiple angle Product, sum and difference formulae. 4.5 Sub-multiple angles. 4.6 Definition of inverse trigonometric, ratios. 4.7 Principal value of inverse trigonometric ratios. Relation between inverse trigonometric ratios. 4.8 Examples on inverse circular functions.
Unit -V Function	5a.Students will be able to Solve the problem of function using the concept of Function	5.1 Cartesian products of sets. 5.2 Definition of relation, definition of function, real value. Function, domain, co-domain of a function. 5.3 Types of Functions. 5.4 Value of the function at given point . 5.5 Composite function. 5.6 Different types of examples on functions .
Unit -VI Limits	6a. Students will be able to Solve the problem of function using the concept of Limit	6.1Definition and concept of limit, limits of algebraic functions. 6.2 Limits of trigonometric functions. 6.3 Limits of exponential functions. 6.4 Limits of logarithmic functions.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY):

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Revision	02	0	0	0	0
2	Determinants and Matrices	12	04	08	12	24
3	Partial Fractions	06	-	04	04	08
4	Trigonometry	14	04	08	12	24
5	Function	04	02	02	04	08
6	Limits	10	04	04	08	16
TOTAL		**48**	**14**	**26**	**40**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICAL/TUTORIAL :

1) The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills so that students are able to acquire the competencies.

2) Form a batch of 20 students and at least 10 problems should be given to get necessary exercise.

Sr. No.	**Title/Topic**	**Exercises/Tutorial**	Approx. hours
1	Determinants and Matrices	Solving problems on cramer's rule Examples on Matrix Addition/Subtraction and Product Co-factors, Ad joint and Inverse of Matrix Solution of Simultaneous Equation using 3X3 Matrix and its Applications	02 02 02
2	Partial Fractions	Examples related Definition and cases	02
3	Trigonometry	Practice Examples: Allied & Compound Angles. Examples related inverse trigonometric ratios	04
4	Function	Examples related Definition and Rules.	02
5	Limits	Examples related to different types of function.	02

8. SUGGESTED STUDENT ACTIVITIES :

--

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any) :

1 Chalk-board method.
2 Projector method.
3 Tutorial method.

10. SUGGESTED LEARNING RESOURCES :

Sr. No.	**Title of Book**	**Author**	**Publication**
1	Mathematics for polytechnic students for first year	S.P.Deshpande	Pune vidhyarti gruh prakshan Pune
2	Mathematics for polytechnic students for first year	G.V.Kumbhojkar	Phadke prakashan Kholapur
3	Mathematics for polytechnics	TTTI Bhopal	TTTI Bhopal

11. Major Equipment/ Instrument with Broad Specifications :

Sr.NO.	Name of the Equipment	Specification
	NA	

12. Software/Learning Websites :

13. POs and PSOs assignment and its strength of assignment with each CO of the Course :

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PSO2	PSO3
CO1	To able the basic concept of Logarithms and Determinant of order 2 and 3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	Students will be able to Solve simultaneous equations using concepts of Determinants and Matrices	3	1	1	-	-	-	-	-	-	-	-	-	-
CO3	Students will be able to solve simple problems Using concepts of Partial Fractions	1	1	1	-	-	-	-	-	-	-	-	-	-
CO4	Students will be able to Solve simple problems by applying using concepts of trigonometry.	3	2	1	-	-	-	-	-	-	-	-	-	-
CO5	Students will be able to Solve the problem of function using the concept of Function	1	1	-	-	-	-	-	-	-	-	-	-	-
CO6	Students will be able to Solve the problem of function using the concept of Limits	1	3	-	-	-	-	-	-	-	-	-	-	-

COURSE CURRICULUM DEVELOPMENT COMMITTEE :

Sr. No	Name of the faculty member	Designation and Institute
		Co-coordinator science and Humanities
1	Mr. M.A. Ali	Lecturer in Mathematics, Government Polytechnic Aurangabad
2	Mr. R.B. Borulkar	Lecturer in Mathematics, Government Polytechnic Aurangabad
3	Mrs. H.H. Bhumkar	Lecturer in Mathematics, Government Polytechnic Aurangabad

Member Secretary PBOS Chairman PBOS

COURSE TITLE **ENGINEERING CHEMISTRY**

COURSE CODE **6G104**

Diploma Programme in which this course is offered	**Semester in which offered**
ME/CE/EE//ET/CO/IT/AE	First/ Second Semester

1. RATIONALE :

Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering materials, their properties, related applications and selection of materials for specific engineering applications/work/job.

Due to technological progress, there are hazardous effects of chemicals, waste water and sewage water on environment & human life. The core knowledge of environmental effects will bring awareness; generate curiosity in students about the precautions & preventions to be taken to carry out further development resultantly to reduce the ill effects.

2. COMPETENCY :

At the end of studying this course students will be able to

"**Apply basic knowledge and principles of chemistry to solve different industrial problems."**

3. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme					
				Theory Marks		Practical Marks		Term work	Total Marks
L	T	P	C	ESE	PT	ESE	PA	ESE	TOTAL MARKS
3	-	2	5	80~	20~	25@	-	25	150
Examination Duration				2Hrs	1/2Hr.	2Hrs.	--	--	--

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES :

After providing classroom teaching and laboratory experiences related to this course, students will be able to

1. Draw the orbital configuration of different elements.
2. Represent the formation of molecules schematically.
3. Compare and use different types of cells.
4. Identify the properties of metals & alloys related to engineering applications.

5. Identify the properties of nonmetallic materials, related to engineering applications.
6. Select a proper material for specific purpose.
7. Select and use the lubricants at proper/ specific conditions of machines.

5. COURSE DETAILS :

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT-I Electronic Theory Of Valency & Molecule Formation	1a.Identification of structure and nature of atom, element and molecule.	1.1 Atomic no, atomic mass no. numerical problems on it , orbit & orbitals. 1.2 Electronic configuration, electronic configuration of first 30 elements. 1.3 Molecule formation: Valency, types of valency, electrovalency and covalency with suitable examples. Study of Formation of Electrovalent compounds e.g. NaCl, $CaCl_2$ & $MgCl_2$ and formation of Covalent Compounds examples H_2O, Cl_2, CO_2, N_2
UNIT-II Electrochemistry	2a.Verify Principle, construction, working and applications of different cells.	2.1 Arrhenius Theory of Ionization, Degree of ionization. 2.2 Basic concepts of Conductors, Insulators, Dielectrics, Electrolyte, Non Electrolyte 2.3 Electrolysis, Electrolytic Cell, Electrodes. 2.4 Electrolysis of $CuSO_4$ Solution by using Cu Electrode & Platinum Electrode 2.5 Faraday's first law of Electrolysis & numerical problems on it Application of Electrolysis such as Electroplating. 2.6 Electrochemical Cells & Batteries Types of cell Primary & secondary cell construction And Working of Dry cell & Lead – Acid Storage.

UNIT- III Metals and Alloys	3a.Identify different mechanical properties and extraction methods of pure metal, Correlate properties, composition and applications of alloys with metal.	3.1 Definition of Metallurgy, Mineral, Ore, Gangue, Flux & Slag, Occurrence of Metals. 3.2 Mechanical Properties of metals such as hardness, Toughness, ductility, malleability, tensile strength. 3.3 Stages of Extraction of Metals from its Ores in detail i.e. its flow sheet Crushing, Concentration, methods of concentration (physical and chemical). 3.4 Reduction of iron in blast furnace with chemical reactions, Reactions in zone of reduction. **Alloys** 3.5 Definition of Alloy, Purposes of Making alloy. 3.6 Methods of Preparation of alloy such as fusion method & compression method 3.7 Classification of Alloys, Ferrous alloys & Non Ferrous alloys, their examples. 3.8 Composition, Properties & Applications of some common alloys such as Alnico, Duralumin, Wood's Metal
UNIT-IV Corrosion of Metals And its Application	4a. Classify corrosion from action of surrounding environment and its protection methods.	4.1 Definition of corrosion 4.2 Atmospheric corrosion or dry Corrosion, corrosion due to oxygen, different types of film formation. 4.3 Electrochemical Corrosion Hydrogen evolution mechanism. 4.4 Appling protective Coatings like metal coating by galvanising, tinning
UNIT-V Water	5a. Recognize ill effect of hard water and methods for purification of water.	5.1 Hard water & soft water, types of hardness, causes of hardness 5.2 Effects of hard water in different industries (such as paper , sugar , dying and textile industries) and domestic purposes. 5.3 Softening of hard water by Permutit process and ion exchange process,. 5.4 Potable water & its condition for pot-ability. Different methods of purification of water for drinking purposes chlorination and ozonation 5.5 pH – value of water its applications

		Numericals on pH values.
UNIT-VI Non Metallic Materials	6a. Identification of types , preparation, properties and applications of plastic, rubber and thermal insulating material.	6.1 Plastics Definition of Plastic, Formation of Plastic by Addition Polymerisation with examples Polyethylene & PVC. 6.2 Formation of Plastic by Condensation Polymerisation with suitable example as Nylon 6, 6; Bakelite plastic. 6.3 Types of Plastics, Thermo softening & Thermosetting Plastic & difference between them. 6.4. Engineering properties of plastic and its related uses. **RUBBER** 6.5 Natural rubber its extraction from latex, drawbacks of natural rubber. Synthetic Rubber its examples 6.6 Vulcanisation of rubber with chemical reaction. 6.7 Properties of rubber such as elasticity, tack, resistant to abrasion, rebound capacity. 6.8 Engineering Applications of rubber based on its properties. 6.9 Thermal insulating materials Definition & characteristics of ideal thermal insulator. Glass wool preparation, properties & applications. Thermocole properties and its applications.

Unit-VII Lubricants	7a. Select proper lubricant for different types of machineries.	7.1 Definition of lubricant and Lubrication. 7.2 Functions of lubricants. 7.3 Classification of lubricants with examples, 7.4 Mechanism of Lubrication by Fluid Film, Boundary & Extreme Pressure, 7.5 Physical Characteristics of Lubricants Such as Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, Cloud & Pour Point. 7.6 Selection of proper Lubricants for Various types of machines.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY) :

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Electronic Theory of Valency and Molecular Formatin	8	2	6	4	12
II	Electrochemistry	6	2	8	2	12
III	Metals and Alloys	8	2	8	4	14
IV	Corrosion of Metals and it's Applications	6	2	4	2	8
V	Water	7	2	2	6	10
VI	Non Metallic Materials	7	4	8	4	16
VII	Lubricants	6	2	4	2	8
Total		**48**	**16**	**40**	**24**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS :

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and psychomotor skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

(Any TEN from following)

Sr. No.	Unit No.	Practical Exercises	Approx. Hrs. required
1	1	Write Orbital electronic configuration of different elements (First 30 elements)	2
2	2	Verify Faraday's first Law of electrolysis.	2
3	7	Find the normality & strength in grams per liter of the given solution (NaOH) with the help of standard hydrochloric acid.	2
4	5	Determine pH value of given solutions, water samples, by using, universal indicator and pH meter.	2
5	7	Determine the normality & strength of given hydrochloric acid solution by titrating it against standard potassium hydroxide solution.	2
6	3	Determine percentage of iron from steel by titration method.	2
7	5	Determine the hardness of potable water and boiler feeding water.	2
8	5	Determine the chloride content potable water and boiler feeding water.	2
9	6	Prepare phenol formaldehyde resin.	2
10	7	Determine the acid value of oil sample by neutralization method.	2
11	2	Qualitative analysis of given salt solutions, i.e. to determine one acidic and one basic radical from given salt solution. (At least 05 salt solutions.)	For each salt solution 2
Micro Project (Any one of following will be opted by a group of 5-6 students)			
Sr. No.	**Unit No.**	**Practical Exercises**	
1	1	Prepare power point presentation to show/demonstrate covalent bond, ionic bond.	
2	4	Effect of acid or alkali on rate of corrosion for different metals.	
3	5	Study of hard and soft water of different samples of water	
4	2	Study of mechanism and working of different batteries.	
5	2	Preparation of small scale batteries/ Galvanic cells. Collect chemicals and material from lab and household and prepare working model of cell.	
6	6	Collect different polymers and prepare the chart on the basis of its type, properties and uses.	

8. SUGGESTED STUDENT ACTIVITIES

a. Verify the properties of different types of compounds used in day to day life.
b. Differentiate properties and uses of different metals.
c. Differentiate composition, properties and application of different alloys.
d. Co-relate the effect of acidic environment with neutral environment.
e. Library survey regarding engineering chemistry topics regarding curriculum.
f. Animated Power point presentation containing current research development related to topics mentioned in curriculum.

9. SPECIAL INSTRUCTIONAL STRATEGIES

a. Search various sites to teach various topics/sub topics.
b. Instead of the traditional lecture method, use different types of teaching methods such as improved lecture method, question answer method, laboratory method to attained specific outcome.
c. Some topics are relatively simpler in nature is to be given to the students for self-learning by seminar or by classroom presentations
d. Teachers provide theme to create multiple choice questions.
e. Provide super visionary assistance for completion of micro-projects.

10. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai and Sons Co. **ISBN 9789352160006**
2	Engineering Chemistry	S. S. Dara	S. Chand Publication **ISBN 8121903599**
3	Chemistry of Engineering Materials	S.N. Narkhede	Nirali Prakashan

11. MAJOR EQUIPMENTS/ INSTRUMENTS WITH BROAD SPECIFICATIONS

Sr. No.	Name of the Equipment	Specification
1	pH meter	Digital ,Range 0 to 14 with Sensitive Glass electrode
2	Distilled water plant	S.S. plant with 15 lit capacity with 2Kv heating coil
3	Kipps's Apparatus	Airtight three section apparatus
4	Electrolytic cell for verification of Faraday's first law	Battery 24V and 5 Ampere , Rheostat 1000 Ohm, Wire, Ammeter 0 to 5 Ampere, Copper plate 3" x 6 " inch

12. E-LEARNING RESOURCES

(Please mention complete URL of the E- resource CO wise)

Sr. No.	Web Address
1	http://www.webelements.com
2	http://www.chemtutor.com
3	http://www.chem1.com
4	https://phet.colorado.edu
5	www.visionlearning.com
6	www.onlinelibrary.wiley.com
7	www.rsc.org
8	www.chemcollective.org

13. POS AND PSOS ASSIGNMENT AND ITS STRENGTH OF ASSIGNMENT WITH EACH CO OF THE COURSE:

CO. No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Draw the orbital configuration of different elements.	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Represent the formation of molecules schematically.	3	2	2	1	-	-	-	-	-	-	-	-
CO3	Compare and use different types of cells.	3	3	-	1	-	-	-	-	-	-	-	-
CO4	Identify the properties of metals & alloys related to engineering applications.	3	3	2	1	-	-	-	-	-	-	-	-
CO5	Identify the properties of nonmetallic materials, related to engineering applications.	3	3	1	2	-	2	-	-	-	-	-	-
CO6	Select a proper material for specific purpose.	2	2	2	1	1	1	-	-	-	-	-	-
CO7	Select and use the lubricants at proper/ specific conditions of machines.	2	2	2	1	1	1	-	-	-	-	-	-

Course Curriculum Design Committee :

Sr. No	Name of the faculty member	Designation and Institute
1	Dr. H.R. Shaikh	Lecturer in Chemistry, Government Polytechnic, Aurangabad
2	Dr. Devdatta V. Saraf	Lecturer in Chemistry, Government Polytechnic, Aurangabad
3	Mrs. R.A. Nemade	Lecturer in Chemistry, Government Polytechnic, Aurangabad
4	Mr. P.K. Shewalkar	Lecturer in Chemistry, Government Polytechnic, Jalna

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSE TITLE ENGINEERING GRAPHICS.

COURSE CODE 6G201

DIPLOMA PROGRAMME IN WHICH THIS COURSE IS OFFERED	SEMESTER
ME, CE, EE, E&TC, AE	**First**

1. RATIONALE:

Engineering Drawing is the language of engineers and technicians. Always the engineers come across different types of drawings. It is therefore very important to understand the fundamentals and basic concepts involved in drawing.

It describes the scientific facts, concepts, principles and techniques of drawings in any engineering field to express the ideas, conveying the instructions, which are used to carry out jobs in engineering fields. The course aim for building foundation for the further course in drawing and other allied subjects.

It covers knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian standards. The curriculum aims at developing the ability to draw and read various drawings, curves and projections.

2. COMPETENCY:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

"Prepare engineering drawings manually with given geometrical dimensions using prevailing drawing standards and drafting instruments."

"Draw orthographic views and isometric views."

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA	100
2	--	2	4	--	--	50@	50	
Exam duration						02 hrs		

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMEs (COs):

1. Draw geometrical figures and scales.
2. Drawing of various engineering curves.
3. Draw orthographic views of given component.
4. Draw isometric view of given component.
5. Use various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.

5. COURSE DETAILS :

Unit	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics (Containing POs and PSOs assignment in each Sub-topic)**
Unit – I Introduction	1 Use drawing equipments and instrumentseffectively. 2 Draw and prepare simple drawings. 3 Follow andapply standard practice as per bureau of I.S. forplanning andlayout. 4 Chooseappropriate scale factor for thedrawing.	1.1 Drawing Instruments and their uses 1.2 Letters and numbers (single stroke vertical) for main title, sub-title and normal use. 1.3 Different types of lines, Convention of lines and their applications. 1.4 Scale (reduced, enlarged & full size), Plain scale and Diagonal scale. 1.5 Sheet sizes and layout, Geometrical Constructions. 1.6 Dimensioning, its methods, parallel and chain dimensioning, radius and diameter dimensioning, leader and itsuse, dimension with text.
Unit – II Simple Drawing Practices	1 Select line types and divide given line, circle into equal number of parts. 2 Draw different regular polygons and circle.	2.1 Drawing of different circles with thin, thick, center line use, dividing circle into number of equal parts, dividing line into equal parts. 2.2 Drawing pentagon, hexagon and rhombus, drawing correct arrows to dimension lines, drawing tangent to circle from given point
Unit – III Engineering Curves	1 Drawengineeringcurves withproficiency andspeed as pergivendimensions. 2 Draw curves with uniform thickness and darkness, dimensioning as per IS.	3.1 To draw ellipse by – • Arcs of circle method • Concentric circle method • Oblong method 3.2 To draw parabola by –

		• Directrix focus method • Rectangle method 3.3 To draw hyperbola by – • Transverse axis & focus method. • Passing through a given point. (Rectangular hyperbola) 3.4 To draw involute of square, Pentagon, hexagon and circle. 3.5 To draw cycloid, epicycloid, hypocycloid.
Unit – IV Orthographic Projections	1 Draw the orthographic views of object. 2 Interpret given orthographic views and imagine the actual shape of the component.	4.1 Converting pictorial view into Orthographic views. (pictorial view of components with holes, cylinders, ribs, plates, slots) 4.2 Sectional orthographic Projection of simple objects. (Use First angle method of Projection).
Unit – V Isometric Projections	1 Draw isometric view of given object. 2 Draw isometric scale.	5.1 Isometric projection of simple objects 5.2 Isometric projection of objects having circular holes, slots on sloping surface.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS &MARKS :
(End semester examination)

Unit	Unit Title	Teaching Hours	Distribution of practical examination marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	4	2	2	2	6
II	Simple Drawing Practices	4	2	2	2	6
III	Engineering Curves	8	4	4	6	14
IV	Orthographic Projections	8	2	4	8	14
V	Isometric Projections	8	2	4	4	10
Total		**32**	**12**	**16**	**22**	**50**

Legends: R = Remembrance; U = Understanding; A = Application and above levels

7. LIST OF EXERCISES/PRACTICALS :

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/ programme outcomes.
A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

S. No.	Unit Number	Practical Exercises	Hrs. required
1	I	1. Drawing of lines of different types, lettering and numbers. 2. Drawing of plain and diagonal scale. 3. Redraw any 2D drawing with circles, slots and curves. Show dimensions on it. **(Drawing on sketchbook.)**	2 2 2
2	II	1. Drawing of regular pentagon, hexagon with standard procedure.Measure internal and external angles. 2. Divide line, circle, and angles in equal number of parts. **(Drawing on sketchbook.)**	2
2	III	**Sheet 1:** Drawing of engineering curves. (3 problems) each on ellipse, parabola and hyperbola. **Sheet 2:** Drawing of Engineering curves. (3 problems) each on scale, involute and cycloid.)	4 4
3	IV	Drawing of Orthographic views from given pictorial view. (Minimum 2 objects onsketchbook) **Sheet 3:** Drawing orthographic views from pictorial view. (2 objects) Use of first angle method only	4 4
4	V	Drawing of Isometric views of simple Objects. (Minimum 2 objects on sketch book). **Sheet 4:** Drawing of Isometric views of simple objects (any 2 objects).	4 4
		Total	32

Notes:
a: Use one side of sheet.
b: Theory & practice should be in first angle projections and IS codes should be

followed wherever applicable.
c: The dimensions of line, distances, angle, side of polygon, diameter, etc. may be different for different batches.
d: The sketchbook has to contain data of all problems, solutions of all problems and student activities performed. Students activities are compulsory to be performed.
e: A hand out containing applicable standards from IS codes including title block as per IS standard should be given to each student by concerned teacher.
f: For ESE Practical examination, students are to be assessed for competencies achieved. Students are to be given data for practical ESE to prepare drawings.
g: At the end of term practical examination of 50 marks of 2 Hours duration is compulsory to all students. External and Internal Examiners should set and assess the Question paper jointly as per following guidelines

- Engineering curves and geometric construction (three problems) 24 marks
- Simple Orthographic projection (One Problem) 16 marks
- Isometric projection with slots and holes (One Problem) 10 marks

8. LIST OF STUDENT ACTIVITIES :

Sr. No.	Activities
1	Sketch the combinations of set squares to draw angles in step of 15 degrees. (15^0 , 30^0 , 45^0 , 60^0 , 75^0 , 90^0 , 105^0 , 120^0 , 135^0 , 150^0 , 165^0 , 180^0).
2	List the shapes you are observing around you in real life with place/item. (For ellipse, parabola and hyperbola).
3	Draw free hand isometric and orthographic views of any components
4	Observe and draw the locus/path of a point on circumference of a rolling wheel.
5	Prepare cuttings of circle and polygons using cardboard/drawing sheet.

9. SPECIAL INSTRUCTIONAL STRATEGIES :

Sr. no.	Unit no	Unit name	Strategy
1	I	Introduction	Conventional black board method, Use of models. Use of software.
2	II	Simple Drawing Practices	Conventional black board method, Use of models.
3	III	Engineering Curves	Planes made of sheet, cardboard.
4	IV	Orthographic Projections	Models, Use of software.
5	V	Isometric Projections	Modelsand cut section.

10. LEARNING RESOURCES:

S.N.	Title of Book	Author and Publication
1	Elementary Engineering Drawing	N.D.Bhatt , Charotar Publishing House
2	Engineering Drawing	Mali , Chaudhari, Vrinda Publication
3	Engineering Drawing	SidheswarShastri , Tata McGraw Hill
4	Engineering Graphics	Arunodaykumar, Techmax publications, Pune
5	Engineering Drawing for schools and colleges	IS CODE SP- 46

11. LIST OF MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS:

S.N.	Major equipment/ Instrument with Broad Specification	Quantity
1	Models- full and cut. (wooden and acrylic)	12
2	Drawing equipments and instruments for class room teaching-large size.	1
3	Drawing board-half imperial size.	100
4	T-square or drafter (Drafting Machine).	1

MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS:

Sr.No.	Name of the Equipment	Specification
1	Various models of standard solids such as pyramid, prism, cone, cylinder etc.	
2.	Different objects or machine elements.	

12. E-LEARNING RECOURSES:

List of Software/Learning Websites.

- http://www.slideshare.net/sahilsahil992/conic-section-1819818
- http://www.technologystudent.com/designpro/drawdex.htm
- http://www.engineeringdrawing.org/engg_curves/problem-3-8-engineering-curves/490/
- http://web.iitd.ac.in/~hirani/mel110-part3.pdf
- http://www.studyvilla.com/ed.aspx
- http://www.youtube.com/watch?v=a703_xNeDao
- E-learning package from KOROS.
- E-learning package from Cognifront.

13 POS AND PSOS ASSIGNMENT AND ITS STRENGTH OF ASSIGNMENT WITH EACH CO OF THE COURSE.

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Draw geometrical figures and scales.	3	3	2	3	-	-	-	-	3	2	2	2
CO2	Drawing of various engineering curves.	3	3	2	3	-	-	-	-	3	2	2	2
CO3	Draw orthographic views of given components.	3	3	2	3	-	-	-	-	3	2	2	2
CO4	Draw isometric views of given component.	3	3	2	3	-	-	-	-	3	2	2	-
CO5	Use various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.	3	3	2	3	-	-	-	-	3	2	2	-

Name and Designation of Course Designer :

1 Prof. Aher S M

2 Prof. Dhirbassi G D

Member Secretary PBOS Chairman PBOS

COURSE TITLE **BASICS OF COMPUTER SYSTEM**

COURSE CODE **6G203**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Common to all branches (CE/ME/EE/ET/CO/IT/AE/DDGM)	FIRST SEMESTER

1. RATIONALE :

This course pertains to basic technology level. It aims to developing fundamentals of Computer and its Applications in students of various programs. This will enable students in using application software's such as word processor, spreadsheets, and power point presentations in their professional fields. Further it will enable students to be lifelong learner.

2. COMPETENCY :

"Use of computer and software application proficiently".

3. TEACHING AND EXAMNATION SCHEME :

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	50
--	--	2	2	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES :

On successful completion of the course, the students will be able to:

1. Connect and operationalize computer system with its peripheral devices.
2. Create and Format documents in Microsoft Word.
3. Create spreadsheets in Microsoft Excel by using formulae.
4. Create and edit basic power point presentations in Microsoft PowerPoint.
5. Use internet for creating email-id, receive and send email with attachment & search information on internet.

5. DETAILED COURSE CONTENTS :

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit- 1 Basics of Computer System	1a.Describe computer hardware and software 1b.Identify & use of I/O devices 1c. Describe functioning of CU ALU and memory unit 1d Differentiate various types of printers 1e. Explain use of OS 1f. Demonstrate various file handling operations	1.1 Concept of Hardware and Software 1.2 Computer block diagram and its component like CPU, Control Unit, Arithmetic logic Unit (ALU) & Memory Unit 1.3 Input Output Devices: Keyboard, Mouse, Scanner, Monitor, Printers: Dot matrix, Laser, Inkjet, Plotters. 1.4 System software and Application Software 1.5 Operating system concepts, purpose and functions 1.6 Operations of Windows OS. 1.7 Creating and naming of file and folders 1.8 Copying file, renaming and deleting of files and folders, 1.9 Searching files and folders, installation application, creating shortcut of application on the desktop 1.10 Overview of control Panel, Taskbar.
Unit-2 Word Processor	2a. Create, edit and save word document using basic text formatting features, page setup options & print options. 2b.Apply spells check & grammatical check in the created document. 2c. Insert graphics/clipart/ smart art/shapes/charts in the document. 2d. Create tables, insert, delete rows and columns and apply different table properties.	2.1 Overview of Word processor 2.2 Basics of Font type, size, colour 2.3 Effects like Bold, italic , underline, Subscript and superscript, 2.4 Case changing options, 2.5 Inserting, deleting, undo and redo, Copy and Moving (cutting) text within a document, 2.6 Formatting Paragraphs and Lists 2.7 Setting line spacing; single, multiple 2.8 Page settings and margins including header and footer 2.9 Spelling and Grammatical checks 2.10 Table and its options, Inserting rows or columns, merging and splitting cells. 2.11 Insert Picture, Clipart, shapes, smart art & charts. 2.12 Working with pictures, Inserting Pictures from Files, Wrapping it with image. 2.13 Finding & replacing text. 2.14 Using Drawings and WordArt; Lines and Shapes, Modifying Drawn Objects. 2.15 Printing: print preview, select printer & appropriate print options.

Unit- 3 Excel (Spreadsheets)	3a. Create, open, save and print worksheet with page setup and print options. 3b. Enter data and insert, delete and format cells, rows and columns. Use formula and functions 3c. Insert formulas, functions and named ranges in worksheet. 3d. Create chart of different types.	3.1 Introduction to Excel, 3.2 Introduction to data, Cell address, Excel Data Types, Concept of hyperlink 3.3 Introduction to formatting number, text and date. 3.4 Concept of worksheet and workbook. 3.5 Understanding formulas, Operators in Excel, Operators Precedence, Understanding Functions, Common Excel Functions such as sum, average, min, max, date, sqrt, power, upper, lower, count, countif, roundup, sin, cos. 3.6 Introduction to charts, overview of different types of charts available with Excel. 3.7 Hide, unhide rows and columns. 3.8 Concept of print area, margins, header, footer and other page setup options.
Unit- 4 Power Point Presentation	4a. Create a simple text slide using formatting, selecting a slide layout and insert pictures & backgrounds. 4b.Use different design templates for creating slides. 4c. Apply slide transitions and slide timings and animation effect for slide show. 4d. Insert hyperlink in the created slides.	4.1 Outline of an effective presentations 4.2 Starting a New Presentation Files, Saving work, 4.3 Creating new Slides, Working with textboxes. 4.4 Changing a slides Layout, Applying a theme, Changing Colours, fonts and effects, Creating and managing custom Colour & font theme, Changing the background. 4.5 Use of design template and auto content wizard. 4.6 Apply animation and transition to slides with timing effect. 4.7 Slideshow: from beginning slideshow, from current slideshow, custom slideshow. 4.8 Creating hyperlinks**,** Using action buttons
Unit- 5 Introduction to Internet	5a. Know different terms related to internet and browsers. 5b. Understand need & duty of ISP & List out different ISP in city. 5c. Use internet for searching information and create, receive & send email with attachment.	5.1 What is the Internet? 5.2 Web pages, Home Pages. 5.3 Use of web sites 5.4 ISP: need & duties of ISP, different ISP in city 5.5 Browsers 5.6 Universal resource locators (URL) 5.7 Browsing or surfing the web 5.8 Search engines 5.9 E-mail and Creation of E-mail ID. Sending & Receiving email with attachment. 5.10 Chatting & Video Conferencing tools: Skype and GTalk 5.11 Applications of the Internet

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN :

Unit No	Title Of Unit	Practical Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Basics of Computer System	08				NA
2	Word Processing	08				NA
3	Spreadsheet	06				NA
4	Presentation	06				NA
5	Introduction to Internet	04				NA
	Total	32				

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS :

Sr.No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Connect the peripherals to a computer system. Get the information about the manufacturers and prices of various components of a PC and laptop.	2
2	1	Start and shutdown of windows, starting different applications. Use of accessories like calculator, paint, notepad & WordPad, Use of system tools like Disk Cleaner, Disk defragmenter, System Information, System Restore & Control panel.	4
3	1	Perform file management operations such as copying, deleting, renaming, creating folders, renaming folders using My computer, Windows Explorer, searching files and folders.	2
4	1	Change windows format such as wall paper, date &time, installing printer, installing and removing programs by using add/remove programs.	2
5	2	Prepare a sample doc files such as resume, application, time table etc. using all word processor tools from menu bar.	6
6	3	Prepare sample spreadsheets such as sample result sheet, salary sheet of employees using all MS-Excel tools from menu bar. (applying excel formulae/functions)	6
7	4	Prepare sample power point presentation by applying MS-Power Point tools such as design template, background, transition and animation effect to slides.	6
8	5	Search information on internet .Use Internet to create email account, send email with attachment, receive email and management of email account.	2
9	5	Use of E-commerce sites, Mobile apps for various online transactions.	2
			32

8. SUGGESTED STUDENTS ACTIVITIES :

Following is the list of proposed student activities like: assignments based on MS-Office, teacher guided self learning activities and lab based mini-projects on MS-Word, MS-Excel and MS-PowerPoint. These could be individual or group-based.

a. Visit institute website.
b. Manage files and folder using Windows.
c. Prepare letter and project report using word processor
d. Create result sheet by inserting student marks and show it in chart form on the same worksheet using Excel spreadsheet.
e. Develop effective presentation of project report using PowerPoint Presentation.
f. Use open source software like openoffice.org (latest version).

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Group based.
b. Q & A technique.
c. Individual based.
d. Activity based learning
e. Self Line learning.

10. SUGGESTED LEARNING RESOURCE :

S.No.	Name of Book	Author	Publication
1.	Fundamentals of computers	P.K.Sinha	BPB Publication
2.	Computer course	R.Taxali	TMGH Publication
3.	MS-Office for Dummies	Wallace Wang	Wiley India, New Delhi
4.	Basic Computer Engineering	Dr. Shailendra Singh, Pawan Thakur, Anurag Jain	SatyaPrakashan, New Delhi, India.
5.	Microsoft Office	Ron Mansfield	BPB Publication
6.	Fundamentals of computers	P.K.Sinha	BPB Publication

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED**:

Sr.No.	Name of equipment	Brief specification
1.	Computer System with latest configuration along with Windows Operating System and latest MS-Office.	Desktop Computer/Personal Computer (Windows OS Prof. Edition/Academic edition) with preloaded operating systems windows 7/windows 8 (academic Lic)
2.	PROJECTOR	Multimedia Projector with wireless connectivity between PC and Projector
3.	PRINTER	HP 1022n laser printer
4.	SCANNER	HPscanner ,Color Scan Method: Color, Flatbed, Mirror Moving Scanner Optical Resolution: 800 x 1600 dpi Maximum Scanning Area 304.8 x 431.8 mm (12x17 inch)
5.	Computer System with latest configuration along with Windows Operating System and latest MS-Office.	Desktop Computer/Personal Computer (Windows OS Prof. Edition/Academic edition) with preloaded operating systems windows 7/windows 8 (academic Lic)
6.	PROJECTOR	Multimedia Projector with wireless connectivity between PC and Projector

12. LEARNING WEBSITE & SOFTWARE :

(Please mention complete URL of the E- resource CO wise)

a. https://www.youtube.com/watch?v=cXBVMyKQ3ZY
b. http://www.gcflearnfree.org/computerbasics/
c. http://www.homeandlearn.co.uk/word2007_2010/Word-2007-2010.html
d. http://www.homeandlearn.co.uk/excel2007/Excel2007.html
e. https://support.office.com/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs) :

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Connect and operationalize computer system with its peripheral devices.	2	2	2	--	--	--	--	--	--	2	--	--
2	Create and Format documents in Microsoft Word.	3	--	3	3	--	--	--	--	--	3	--	--
3	Create spreadsheets in Microsoft Excel by using formulae.	3	--	3	3	--	--	--	--	--	3	--	--
4	Create and edit basic power point presentations in Microsoft PowerPoint.	3	--	3	3	--	--	--	--	--	3	--	--
5	Use internet for creating email-id, receive and send email with attachment & search information on internet.	1	1	1	1	--	--	--	--	--	1	--	--

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	R.T.Aghao	Sr.Lecturer in APM Dept. , Govt. Polytechnic, Aurangabad
2	O.R.Varma	Lecturer in IT Dept., Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE ENGLISH

COURSE CODE 6G301

Diploma Programme in which this course is offered	Semester in which offered
Common to all programmes	First

1. RATIONALE :

English language has become a supreme necessity to pick up a solid core of knowledge. It has a power of linking us with the outside world. Competency in English is also important in business matters like transactions including e-mails, memos, reports and contracts in writingnot only for Indian industry, but also worldwide. Students having proficiency in reading, writing and speaking English has become a prospect of employment in the industry. Hence, this course is designed to help the students to communicate in English effectively.

2. COMPETENCY:

At the end of studying this course students will be able to

"Communicate in English language in spoken and written form."

3.TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE	PA	
2	-	2	4	80	20	-	25*	125
Exam Duration				3 Hrs	1 Hr	-	-	-

(*): *Out of 25 marks, 05 marks -micro-project assessment; 20 marks-progressive assessment.*

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES:

1. Interpret the meaning of new words from the text.
2. Formulate grammatically correct sentences using new words.
3. Prepare resume in proper format.
4. Use relevant vocabulary to construct sentences.

5. COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT-I Comprehension	1a. Understanding meaning of new words from the text. 1b.Write summary of the text 1c. Responding to the questions from the text 1d. Express ideas and views on learned topics	**Text from the book &Vocabulary Building** 1.1.Man Versus Machine—M..K..Gandhi 1.2. Say No to Plastic Bags 1.3. Interview of Dr.A.P.J.AbdulKalam 1.4. Dare to Dream-N.R.Narayan Murthy 1.5. The History Maker—MaltiHola
UNIT-II Functional Grammar	2a. Apply correct verbs in given sentences 2b. Use of correct structures in writing 2c. Identify different types of sentences 2d. Apply correct auxiliaries 2e. Use appropriate connectors in the given sentences 2f. Use appropriate prepositions in the given sentences 2g. Apply correct and exact rules and structures to transform the sentences 2h. Use of correct punctuations in writing	**Functional Grammar** 2.1.Tenses & Time 2.2. Sentence Patterns 2.3. Types of Sentences 2.4. Modal Auxiliaries 2.5. Connectors 2. 6. Prepositions 2.7. Voice, Degree and Reported Speech 2.8. Punctuation Marks
UNIT-III Craft of writing	3a. Writing a paragraph effectively 3b. Writing e-mail in proper formats 3c. Prepare resume in suitable format	3.1.Paragraph Writing 3.2.E-mail writing 3.3. Resume Writing
UNIT-IV Listening & Speaking Skills	4a. Formulate sentences using new words 4b. Enrich vocabulary through reading and listening 4c. Follow correct pronunciations, intonations & accents in communication	4.1. Importance of effective listening 4.2.Barriers in listening and how to overcome them 4.3Problems in speaking English faced by Indian Students

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY):

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Text from the book & Vocabulary Building	12	08	12	10	30
II	Functional Grammar	12	05	08	13	26
III	Craft of Writing	06	04	04	08	16
IV	Listening & Speaking Skills	02	02	02	04	08
	Total	**32**	**19**	**26**	**35**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

7.SUGGESTED EXERCISES/PRACTICALS :

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1.	I	Make Sentences Using Correct Collocations	04
2.	II	Frame Sentences Using Appropriate Preposition/Conjunction	04
3.	III	Make Sentences Using Correct Tenses	04
4.	IV	Make Sentences Using Seven Basic Sentence Patterns	04
5.	V	Transform Sentences in Reported Speech	04
6.	VI	Prepare an Effective Resume in a Proper Format	04
7.	VII	Draft Formal E-mails	04
8.	VIII	Listen a Paragraph/Speech/Story and Make a Summary	04
Total			**32**

8. SUGGESTED STUDENT ACTIVITIES :

Following is the list of proposed student activities like:

a. Read newspapers daily.

b. Solve exercises on lexical items.

c. Use apps for practice.
d. Use pocket dictionary to increase vocabulary.
e. Listen the news bulletin on radio.
f. Play different word games to improve vocabulary.
g. Write different articles & posts.
h. Practice role-playing.
i. Write a story of own experiences.
j. Practice listening comprehension.
k. Collect articles from newspapers & make a collection.
l. Practice paragraph writing.
m. Collect different business letters.

9.SPECIAL INSTRUCTIONAL STRATEGIES (if any) :

a. Arrange different competitions to solve various grammatical items.
b. Motivate students to listen, speak, read and write English in their day-to-day life.
c. Student centered methods and techniques of teaching and learning e.g. group discussion, role-play, individual and group assignments should be used so as to make the students actively participate in the teaching-learning process.

SUGGESTED TITLES FOR MICRO-PROJECTS :

A micro-project is planned to be undertaken by a student. He/she ought to submit it by the end of the semester to develop the industry oriented COs. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty**:**

a. The use of English language in the user manual of electronic appliances used at home.
b. Prepare an advertisement for five daily used products using contextual vocabulary.
c. Observe environmental problems in your locality and frame at least ten slogans to createan awareness.
d. Take an interview of any successful person in your locality in context with his life journey, inspiration, social contribution, role model and keys to success.
e. Prepare a leaflet giving information about your institute.
f. Write a review of your favourite movie/drama/novel.
g. Find out the difficulties in speaking English faced by the students from rural areas.

10. SUGGESTED LEARNING RESOURCES :

Sr. No.	Title of Book	Author	Publication
1	English Grammar & Composition	R. C. Jain	Macmillan
2	Business Letters & E-mails	JyotiNandedkar	Saket Pub.
3	Business Correspondence and Report writing	R. C. Sharma & Krishna Mohan	Tata McGraw Hill
4	Contemporary English Grammar	David Green	Macmillan
5	A Communicative Grammar of English	Geofray Leech &Jansvartvik	Pearson Education
6	*Spectrum- A Text Book on English	-	MSBTE
7	* A Text Book on English	-	MSBTE

11. Major Equipments/ Instruments with Broad Specifications

Sr.No.	Name of the Equipment	Specification
1	Digital English Language Laboratory	
2	Computers and Headphones	
3	Magazines,Articles,Journals in Lab.	

12. E-learning resourses

(Please mention complete URL of the E- resourses CO wise)

1	https://www.nptel.ac.in/courses
2	https://www.k12reader.com
3	https://www.eduaction.com
4	https://www.k5learning.com
5	https://www.english4u.com

13. POs and PSOs assignment and its strength of assignment with each CO of the Course

CO NO	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Interpret the meaning of new words from the text.	3	1	1	1	1	1	1	1	3	1	-	-
CO2	Formulate grammatically correct sentences using new words.	3	1	1	1	1	1	1	1	3	1	-	-
CO3	Prepare resume in proper format.	1	1	2	1	3	3	2	3	3	3	-	-
CO4	Use relevant vocabulary to construct sentences.	1	1	1	1	1	1	1	1	2	1	-	-

Course Curriculum Design Committee

Sr. No	Name of the faculty member	Designation and Institute
1	Mrs. P.Y. Kamble	Lecturer in English, Government Polytechnic, Aurangabad
2	Mrs. M.S. Ban	Lecturer in English, Government Polytechnic, Aurangabad
3	Mr. P.V. Deshmukh	Lecturer in English, Government Polytechnic, Aurangabad
4	Mr. R.L. Korde	Lecturer in English, Government Polytechnic, Aurangabad
5	Mr. D.D. Gangthade	Lecturer in English, Government Polytechnic, Aurangabad
6	Mr. A.P. Jagtap	Lecturer in English, Government Polytechnic, Osmanabad

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSE TITLE ENVIRONMENTAL SCIENCE
COURSE CODE 6G304

DIPLOMA PROGRAMME IN WHICH THIS COURSE IS OFFERED	SEMESTER
ME, CE, EE, E&TC, CO, IT, AE	**FIRST**

1. RATIONALE:

The present plight of the world as a victim to a number of environmental setbacks ranging from global warming, ozone layer depletion, acid rains led to alarmingly increase in world pollution levels. This has led to the dangerous situation threatening existence of biosphere on the earth. Diploma engineers also get confronted with this issue in their professional life.. Diploma engineers need to be aware of environment and associated issues so that he can help in protection and preservation of environment.

2. COMPETENCY:

"Contribute in overall preservation of eco system of organization."

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PT	ESE (PR)	PA	50
-	-	2	2	--	--	--	50	
Exam duration			--	--	--	--	--	

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES :

At the end of this course, students would be able to -

1. Analyze and assess the impact of biodiversity and its loss on environment
2. Identify causes of pollution in working system and apply control measures for prevention.
3. Apply provisions of various environmental protection acts in practice.
4. Appreciate correlation between Human population and its effect on environment.
5. Read, analyze and apply various laws and regulations concerning environmental issues.

5. COURSE DETAILS:

Unit	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics**
Unit –I Environment and studies	1a. Write genesis of environmental concerns 1b. Identify the various types of environmental issues.	1.1 Definition , Scope and importance of Environmental studies 1.2 Meaning of environment, , Environment and its components, Segments of environment, scientific aspects 1.3 Global environment crisis and factors affecting it. Deforestation. aquatic life and tsunami effects ,Population, Carbon dioxide emissions, pollution, Extinction of species etc. Ecological Foot print
Unit– II Environmental Natural Resources	2a. Classify different resources 2b. Outline issues associated with different resources. 2c. Develop strategies to conserve of natural resources.	2.1. Renewable and Nonrenewable natural resources and associated issues as under, a. Forest resources b. Water resources c. Energy resources d. Land resources e. Food resources f. Energy resources 2.2. Role of individual in conservation of natural resources
Unit– III Ecosystems	3a. Outline ecosystem. 3b. Categorize various ecosystems.	3.1 Concept of Ecosystem 3.2 Structure and function of ecosystem 3.3 Structure and functions of following ecosystems, a. Forest Ecosystem b. Grassland Ecosystem c. Desert Ecosystem d. Aquatic ecosystem
Unit– IV Biodiversity and Conservation	4a. Outline Biographical classification of India 4b. Assess Biodiversity loss and its impact.	4.1 Introduction, Values of the Biodiversity, Biographical classification of India 4.2 Biodiversity loss and its impact 4.3 Conservation of Biodiversity, Efforts made in India.
Unit - V Environmental	5a. Describe pollution and its types 5b. Describe cause, effect	5.1 Definition of pollution and its types 5.2 Causes, effects and control measures of following types of pollutions

Pollution	relationship. 5c. Conduct Survey on Environmental Pollution	a. Air Pollution b. Water Pollution c. Soil Pollution d. Marine Pollution e. Thermal Pollution f. Nuclear hazards and pollution 5.3 Pollution norms, rules and bye laws 5.4 Solid waste management: Causes, Effects and control measures of urban and industrial waste.
Unit – VI Social Issues and Environment	6a. Identify social issues related to environment 6b. Suggest control measures to counter the issues, .	6.1 Urban problems related to Energy, Measures of water conservation including Rain water harvesting, Watershed Management 6.2 Climatic changes, Global Warming, Acid rain, Ozone layer depletion issue, Nuclear accidents and holocaust. Kyoto Protocol, Climate justice 6.3 Introduction to Environment (protection) act(prevention and control of pollution),Wildlife protection act, Forest protection act Air (Prevention and control of pollution) Act, Water related Environment laws ,issues in enforcement of environmental legislation, public awareness.
Unit – VII Human population and environment	7a. Use of ICT in environment and human health areas.	7.1Concepts of Population Growth, Environment and human health, Role of information technology in environment and human health

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY) :

Unit	Unit Title	Teaching Hours	Distribution of practical examination marks			
			R Level	U Level	A Level	Total Marks
I	Environment and studies	4	NA	NA	NA	NA
II	Environmental Natural resources	4	NA	NA	NA	NA
III	Ecosystems	4	NA	NA	NA	NA
IV	Biodiversity and conservation	4	NA	NA	NA	NA
V	Environmental Pollution	8	NA	NA	NA	NA
VI	Social issues and environment	4	NA	NA	NA	NA
VII	Human population and environment	4	NA	NA	NA	NA
Total		32	NA	NA	NA	NA

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS :

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Here all the practical exercises are to be completed by students in a group. The group size should be 10 to 12. The groups should be formed by concerned teacher in consultation with students Every group should be assigned a group leader. All groups will complete the practical assignments in spare time and during Sundays and holidays. No separate time slots will be allotted to these practical exercises. Teacher will guide and give necessary inputs for modus operand of exercises.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Prepare report on environmental issues of your institute / Selected Premises	04
2	II	Collect information related to natural resources of India and methods adopted for conservation of these resources	02

3	I, II	Prepare "Energy Audit Report" of a small home. And give suggestions for conservation of energy.	02
4	III, IV	Examine water usage of a small community/locality in city/Apartment /Your Institute and prepare a Report on actions that could be taken to conserve the water fron following point of view: How much water is consumed How much wastage of water occurs How can demand of water be reduced How can ecological footprint of water they get can be reduced What other environment friendly ways of getting water can one implement What is the quality of water and how can it be improved How reuse and recycling of water can be done How users can be educated for proper use of water	02
5	I,II,III, VI	Visit, "Roof water harvesting" system installed in nearby area and prepare a detailed report. Include local bodies legislation as regards roof water harvesting	02
6	I,II,III	Undertake "Tree plantation project" and plant at least 03 trees per student in your Institute. Prepare detailed report on tree plantation.	02
7	I,II,III	Visit ,study and analyze a "Solar systems" installed in nearby area and prepare a detailed report. Include following types of systems, a.Household Solar water heating systems b. Solar P-V Systems c.Solar roof top Net metering systems	02
8	IV	Preparation of Biodiversity Report: Select a small park or garden in your area.Prepare a Biodiversity register: list all the species found in place ,find their scientific names with the help of a botanist. Interview long term users of the place and find out about loss of biodiversity. Write a report describing your observations and your recommendations for conservation of biodiversity.	04
9	V	Prepare a report on water pollution scenario in your institute and make a detailed report. Following activities can be undertaken with permission, Locating and studying water consumption locations in institute like Water coolers , R.O units, Filters, taps. Taking and checking drinking water samples periodically from testing authorities and keeping records. Preparing and executing schedule for cleaning water tanks, water filters, RO units etc.	06
10	V	Prepare report Vehicular pollution checking in your institute: Here sample check the two wheelers, four wheeler vehicles of employees, students with the help of Exhaust gas analyzer / Smokemeter periodically and check the levels of pollution.	02
11	V	Prepare report of Noise and Air pollution levels at a crowded square of city using Deciblemeter and Air sampling device	02
12	VI	Collect information on Global Warming,Acid rain, Ozone	02

		layer depletion issue,Nuclear accidents and holocaust. Kyoto Protocol, Climate justice, Environment protection laws and regulations.	
			Total 32

8. SUGGESTED STUDENT ACTIVITIES:

Following is the list of proposed student activities like:

1 Search different journals on Environment
2 Collect info of Environmental laws and regulations from websites.
3 Collect various news paper cuttings on the issues of environment
4 Observe and celebrate following important days on environment,
- 22 April- Earth Day
- 1 – 7 July – Vanamahotsava Week
- 11 International Mountain day
- 2 February –Worlds wetland day
- 5 April – National Maritime day
- 8 June – World Oceans day
- 22 May – international Day of Biological diversity
- 22 March – World Water day.
- 21 March – World Forestry Day
- 16 October –Worlds food day
- 22 September –Car free day
- 29 October-National disaster reduction day
- 21 July – Worlds Population day
- 8 March – Womans day

5 Prepare charts, banners, posters on environment and its protection and display in class, notice boards.
6 Participate in social campaigns concerning environment and its preservation.
7

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATEGIES:

1. Q & A Techniques.
2. Field Visits
3. Expert Lectures.

10. SUGGESTED LEARNING RESOURCES :

S. No.	**Title of Book**	**Author**	**Publication**
1	Environmental Studies	R.Rajgopalan	OXFORD university press
2	Environmental Studies	Anindata Basak	Pearson education
3	Air Pollution	M.N. Rao	Tata Macgrawhill
4	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall
5	Introduction to Environmental Engineering	P.AarneVesilind and Susan Morgan	Thomson

11. MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS :

Sr. No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Biological Microscope	01
2	Air sample testing setup	01
3	Water sample testing setup	01
4	Exhaust gas Analyzer	01
5	Smoke meter	01
6	PC with Net connectivity	01
7	LCD Projector	01

12. E-LEARNING RESOURCES:

(Please mention complete URL of the E- recourse CO wise)

1. www.unep.org
2. www.ipcc.ch
3. www.grida.no
4. www.wildlifeinindia.com
5. www.fsi.nic.in/sfr_2009.htm
6. www.unesco.org
7. www.chilika.com
8. www.foodfirst.org/media/opeds/2000/4-greenrev.html
9. www.cites.org
10. http://projecttiger.nic.in/
11. www.iwmi.cgiar.org/
12. www.worldwater.org
13. www.indiaenergyportal.org
14. http://www.lifeaftertheoilcrash.net/
15. www.mmpindia.org/
16. www.pcri.com
17. http://www.unwater.org/statistics_pollu.html

List of Films

1. The 11th hour
2. The many faces of madness
3. Planet Earth-BBC documentary
4. The childrens of Amazon
5. The Blue Planet-BBC documentary
6. End of Line
7. The State of planet – BBC Documentary
8. The truth about Tigers
9. Bringing home rain- A film by SushamaVeerappa.
10. Drinking the sky – BBC documentary
11. A Crude Awakening :The OIL Crash – A documentary by Basil Gelpke
12. Poison on a platter – Documentary by Mahesh Bhatt
13. The story of bottled water – A documentary by Annie Leonard on packaged water industry.(Download from www.storyofstuff.org)

13. POS AND PSOS ASSIGNMENT AND ITS STRENGTH OF ASSIGNMENT WITH EACH CO OF THE COURSE:

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Analyze and assess the impact of biodiversity and its loss on environment.	2	--	--	--	2	2	--	--	--	--	--	--
CO2	Identify causes of pollution in working system and apply control measures for prevention.	--	--	--	--	2	2	--	--	--	--	--	--
CO3	Apply provisions of various environmental protection acts in practice.	2	--	--	--	3	3	--	--	3	--	--	--
CO4	Appreciate correlation between Human population and its effect on environment.	2	--	--	--	2	2	--	--	3	--	--	--
CO5	Read, analyze and apply various laws and regulations concerning environmental issues.	2	--	--	--	3	3	--	--	--	--	--	--

Course Curriculum Design Committee:

Sr No	Name of the faculty members	Designation and Institute
1	Prof.S.P.Shiralkar	Lecturer in Mechanical Engineering Department
2	Prof. A.B. Deshpande	Lecturer in Mechanical Engineering Department

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ENGINEERING PHYSICS**
COURSE CODE **6G103**

Diploma Programmes in which this course is offered	Semester in which offered
ME/CE/ET/EE/CO/IT/AE	First/Second Semester

1. RATIONALE:

Engineering Physics represents foundation level of courses. It is considered as the mother of all engineering programmes. The principles, laws, hypothesis, concepts, ideas which are acquired by students through this course help in reinforcing the knowledge of technology and solving engineering problems.

2. COMPETENCIES:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies…

I. Apply facts, concepts and principles of Physics for solving various Engineering Problems
II. Observe, describe, interpret and interact with physical and engineering world through concepts and principles of physics.

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			**Total Credits (L+T+P)**	**Examination Scheme**				
				Theory Marks		**Practical Marks**		**Total Marks**
L	T	P	C	ESE	PT	ESE	PA	**150**
3	0	2	5	80~	20~	25@	25	
Exam Duration				2 Hrs.	1 Hr.	2 Hrs.		

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES:

Students will able to

1. Determine relevant physical properties of a given material.
2. Analyze thermal, optical and acoustical system using properties of heat, light and sound.
3. Apply fundamentals electrical laws.

4. Select different type of semiconductors, x-ray and optical fibre application.

5. COURSE DETAILS:

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT-I General Properties of Matter	1a. Measure Strength parameter. 1b. Measure automization and lubricity of given liquid.	**Elasticity:** 1.1 Definitions of deforming force, restoring force, elasticity, plasticity, Factors affecting elasticity.· 1.2 Stress Tensile, Compressive, Volumetric and Shear stress, Strain: Tensile, Volumetric and Shear strain. 1.3 Elastic limit, Hooke's law. Elastic co-efficient- Young's modulus, bulk modulus, modulus of rigidity and relation between them **Viscosity** 1.4 Viscous force, definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its SI unit. 1.5 Streamline and turbulent flow with examples, critical velocity, Reynold's number and its significance. **Surface tension** 1.6 Cohesive and adhesive force, Laplace's molecular theory of surface tension, Surface Tension: definition and unit, 1.7 effect of temperature and impurity on surface tension. Angle of contact, Capillarity and examples of capillary action 1.8 derivation of expression for surface tension by capillary rise method, applications of surface tension.

UNIT-II Heat Light And Sound	2a. Analyze thermal system. 2b. Analyze optical system. 2c. Analyze acoustic system.	**Heat** : 2.1 Three modes of transistor of heat , conduction convection Radiation , law of thermal conductivity 2.2 Coefficient of thermal conductivity , , expansion of solid and coefficient of linear , aerial and cubical expansion & relation between them **LIGHT** : 2.3 Introduction to reflection and refraction of light, Snell's Law, 2.4 Dispersion. Total internal reflection of light. Critical angle, Simple problems. **Properties of sound** : 2.5 Wave motion transverse & longitudinal wave 2.6 Free & forced vibration , Resonance formula calculate velocity of sound by resonance tube method
UNIT-III Electrostatics And Current Electricity	3a.Analyze electrical system.	3.1 Electric charge, Coulomb's Law of Charges, Unit charge, field, intensity of electric field, electric lines of forces (Properties) Electric Flux, Flux Density. 3.2 Concept of resistance, Specific resistance, Whetstone's network, meter bridge, balancing condition of meter bridge, measurement of unknown resistance using meter bridge. Problems. 3.3 Potential , Potential drop along the length of wire, Principle of Potentiometer, Potential gradient, E.M.F. Unit, Comparison of EMF using potentiometer

UNIT-IV Modern Physics	4a. Use modern materials 4b. Use X-ray	**Semiconductor :** 4.1 Classification of solids on the basis of band theory: forbidden energy gap, conductor, insulator semiconductor 4.2 Intrinsic, extrinsic, semiconductor doping, P and n type semiconductor electrical conduction through p and n semiconductor .P-N junction diode semiconductor metal and insulator. 4.3 Optical fibre: principle, structure of optical fibre, propagation of light wave through optical fibre, derivation of numerical aperture and acceptance angle **X-rays:** 4.4 Origin of X-rays, production of X-rays using Coolidge's X-ray tube 4.5. Minimum wavelength of X-ray derivation, properties of X-rays, applications of X- rays: engineering, medical and scientific

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY) :

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	GENERAL PROPERTIES OF MATTER	12	6	7	7	20
2	HEAT LIGHT AND SOUND	12	6	7	7	20
3	ELECTRICITY	12	6	7	7	20
4	MODERN PHYSICS	12	6	7	7	20
	TOTAL	48	24	28	28	80

Legends:
R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

7. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS:

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Sr. No.	Unit No.	Experiment /Practical Exercises	Approximate Hours
1	1	Know your Physics Laboratory and use of scientific calculator & interpretation of graph.	2
2	2	Measure the dimensions of given objects using vernier caliper.	2
3	3	. Determine Young's modulus of elasticity of metal wire by using Searle's apparatus	2
4	4	Measurement of unknown temperature using platinum resistance thermometer.	2
5	5	To determine critical angle using glass block	2
6	6	. Determine coefficient of viscosity of given liquid using Stoke's Method	2
7	7	To determine specific resistance of given wire using Ohm's Law	2
8	8	To verify the Law of Resistance in series by Meter bridge.	2
9	9	To study the forward characteristics of P-N junction diode	2
10	10	To understand the concept of resonance and determine the velocity of sound in air.	2
11	11	Comparison of EMF of two cells using Potentiometer	2
Micro Project (Any one of following will be opted by a group of 5-6 students)			
1	Survey of different diodes, resistances and capacitance		
2	Prepare current and voltage rating of home appliances		
3	To make the telescope using lenses		
4	Analyse the different toys and watch on the basis of property of Elasticity		
5	Analyse the different liquidator on the basis of property of surface tension		
6	To collect the information from internet regarding distribution of sound at Gowalkonda fort		
7	To collect the information from internet regarding distribution of sound at Golghumut at Vaijapur		

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES:

Following is the list of proposed student activities

a. Calculate acoustics of given class room.
b. Prepare a chart of applications of optical fibre in different fields.
c. Demonstrate different types of capacitors.
d. Seminar by student on any relevant topic.

9. SPECIAL INSTRUCTIONAL STRATEGIES:

a. Search various sites to teach various topics/sub topics.
b. Instead of the traditional lecture method, use different types of teaching methods such as improved lecture method, question answer method, laboratory method to attained specific outcome.
c. Some topics are relatively simpler in nature is to be given to the students for self-learning by seminar or by classroom presentations
d. Teachers provide theme to create multiple choice questions.
e. Provide super visionary assistance for completion of micro-projects.

Hour's distribution for Physics Experiments:

Sr. No.	Description	Hours
1	An introduction to Physics laboratory and its experiments (for the set of first four experiments)	02
2	Set of first four experiments	08
3	An introduction to experiments (for the set of next four experiments)	02
4	Set of next four experiments	08
5	An introduction to experiments (for the set of next three experiments)	02
6	Set of next three experiments	06

10. SUGGESTED LEARNING RESOURCES LIST OF BOOKS:

Sr No.	**Title of Books**	**Author**	**Publication**
1	Basic Science Physics	Pawar and Sutar	Nirali Publication
2	Applied Physics	B.G. Bhandarkar	Vrunda Publication
3	Engineering Physics	R.K. Gupta and S.L Gupta	Dhanpat Rai Publication
4	Applied Physics	Pawar, Umrani and Joshi	Nirali Publication
5	Basic Physics	B.G. Bhandarkar, S.N. Jumde	Vrunda Publication
6	Physics Text Book Part -1 for Class - 12	NCERT	NCERT; 2014 edition **ISBN-13:** 978-8174506313
7	Physics Text Book Part -2 for Class - 12	NCERT	NCERT; 2014 edition **ISBN-13:** 978-8174506719
8	A text book of applied physics		S Chand Publication

11. List of Major Equipment/ Instrument :

1. Platinum resistance thermometer
2. Thermocouple
3. Meter bridge
4. Potentiometer

12. E-learning resources :

1. www.physicsclassroom.com for unit II and unit III
2. www.fearofphysics.com for unit III
3. www.sciencejoywagon.com/physicszone for unit III and IV
4. www.science.howstuffworks.com
5. https://phet.colorado.edu/en/simulations/category/physics for unit I, II, III and IV

13. POs and PSOs assignment and its strength of assignment with each CO of the Course:

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Student will able to calculate young's modulus ,surface tension and viscosity of different material	3	3	3	2	-	1	-	-	-	2	-	-
CO2	Student will able to demonstrate different properties of heat ,light and sound	3	3	2	2	-	2	-	-	-	1	-	-
CO3	Student will able to demonstrate different laws of electric field, charge resistance and capacitance	3	3	3	3	-	2	1	-	-	1	-	-
CO4	Student will able to demonstrate different type of semiconductors, x-ray and optical fiber knowledge and application	3	3	3	3	-	3	-	-	-	-	-	-

Course Curriculum Design Committee

Sr. No	Name of the faculty member	Designation and Institute
1	Mr. V.S Deshmukh	Lecturer in Physics, Government Polytechnic Aurangabad
2	Mrs. S.B.Kale	Lecturer in Physics, Government Polytechnic Aurangabad
3	Mrs. Z.F.Siddiqui	Lecturer in Physics, Government Polytechnic Aurangabad

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSE TITLE ENGINEERING MECHANICS

COURSE CODE 6Q201

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Civil/Mechanical/Automobile	Second

1. RATIONALE:

Engineering Mechanics is basic technology course. The purpose of this course is to predict physical phenomena which lay the foundations for engineering applications. By applying Principles of mechanics, Diploma engineers shall be able to analyze the behavior of structural/machine components under the action of various forces. Analysis of components will form basis for design. The Course intends to provide basic understanding about the different types of forces, moments and their effects on structural/machine components. It develops basic analytical abilities.

2. COMPETENCY:

At the end of studying this course students will be able to,

"Use principles of engineering mechanics to analyze structural/machine components"

3. TEACHING AND EXAMNATION SCHEME:

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	125
4	-	2	6	80	20	--	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-**Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal, ~ Online Examination.

4. COURSE OUTCOMES :

At the end of studying this course students will be able to: -

1. Classify the given force system.
2. Suggest the appropriate simple lifting machines for given situations.
3. Check the stability of engineering systems by applying force equilibrium conditions
4. Use principles of friction to analyze equilibrium of rigid bodies/simple structures for common engineering situations.
5. Locate the Centroid and Centre of gravity of components of engineering systems.

5. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Fundamental Concepts	1a. Explain concepts of given terms 1b. Classify the given quantities 1c. Use Newton's laws of motion in given situations 1d. Use law of transmissibility in given situations	1.1 Definitions of Mechanics, Applied Mechanics, statics, dynamics, kinematics, kinetics. 1.2 Concept of space, time, mass, particle, rigid body. 1.3 Scalar and vector quantities with examples, 1.4 Newton's laws of motion. 1.5 Concept of force, definition, S.I. unit, representation of force as a vector, Bow's notation. Characteristics and effects of forces, Law of transmissibility of force.
Unit – II Simple lifting machines	2a. Suggest appropriate simple lifting machine for the given purpose along with justification 2b. Determine effort required for the load lifted by the given simple lifting machine 2c. Determine the V.R. and efficiency and law of given simple lifting machines. 2d. Draw and interpret the graphs for given data.	2.1 Definition of simple lifting machine, load, effort, mechanical advantages, velocity ratio, input of a machine, output of a machine, efficiency, and relation between MA, VR and efficiency. Ideal machine, ideal effort, ideal load, friction in machine, effort lost in friction, load lost in friction. 2.2 Law of simple machine, maximum mechanical advantage, and efficiency, reversibility of machine, condition for reversibility of machine, self-locking machine. 2.3 Velocity ratio (No derivation) for Worm and worm wheel, differential axle and wheel, Single/double purchase crab, Simple screw jack, Two and three sheave pulley block, Weston's differential pulley block. 2.4 Numerical problems based on the above machines as mentioned in article 2.3 2.5 Graphs of Load V_S Effort, Load V_S ideal

		effort, Load V_S Effort lost in friction, Load V_S M.A., Load V_S Efficiency
Unit - III Resolution and composition of coplanar forces	3a. Resolve the given single force. 3b. Determine analytically resultant of given force system. 3c. Determine graphically resultant of the given force system.	3.1 Concept of system of forces: Coplanar, Non coplanar, collinear, concurrent, non-concurrent, parallel (like & unlike). 3.2 Resolution of a force – Orthogonal and non orthogonal components 3.3 Composition of forces, definition of resultant, Law of parallelogram of forces and Law of polygon of forces. 3.4 Determination of resultant of collinear and concurrent force system analytically. 3.5 Moment of a force, magnitude, lever arm, types and sign convention,. Law of moment, Varignon's theorem, Couple, characteristics of couple with examples. 3.6 Resultant of parallel force system and non-concurrent, non-parallel force system by analytical method. 3.7 Resultant of parallel and concurrent coplanar force system by graphical method
Unit - IV Equilibrium of coplanar forces	4a. Draw free body diagram (F.B.D.) of a rigid body / object for the given situation. 4b. Use Lami's theorem in given situation. 4c. Determine analytically reactions for the given type of beam. 4d. Determine graphically reactions for the given simply supported beam.	4.1 Equilibrium and equilibrant, relation between resultant and equilibrant. 4.2 Concept of free body, free body diagram, Conditions of equilibrium for collinear, concurrent, parallel & non concurrent non parallel force systems. 4.3 Lami's Theorem and its applications such as cables. Lami's theorem problems with two unknowns only. 4.4 Beam-Definition, types of beam: cantilever, simply supported, over hanging, continuous, fixed beams. Types of supports: simple, fixed, hinged and roller. Types of load- point load (vertical and incline), uniformly distributed load, couple. 4.5 Beam reactions for cantilever, simply supported beam with or without overhang-subjected to combination of point load and U.D.L. or vertical point load and couple.

		4.6 Using graphical method determine beam reactions for the simply supported beam (without overhang) subjected to vertical load and U.D.L.
Unit - V Friction	5a. Determine frictional force, coefficient of friction and unknown forces acting on body(s) for the given situation. 5b. Determine frictional force, coefficient of friction unknown forces acting on ladder in given situation.	5.1 Concept and definition of friction, Advantages and disadvantages of friction. Types of friction (static, dynamic, rolling, sliding), laws of friction, Definition of co-efficient of friction, angle of friction, angle of repose and relation between angle of friction and angle of repose. 5.2 Equilibrium of bodies on level plane subjected horizontal & incline force (pull and push). 5.3 Equilibrium of bodies on inclined plane subjected to parallel & incline force (pull and push). 5.4 Ladder friction. (With one surface smooth)
Unit - VI Centriod and Center of gravity	6a. Determine centroid of the given composite lamina. 6b. Determine center of gravity of the given composite solids.	6.1 Centroid- Definition, Centroid of geometrical plane figures- triangle, square, rectangle, circle, semicircle, quarter circle. 6.2 Determination of centroid of composite figures composed of not more than three geometrical regular figures. 6.3 Center of gravity- Definition, C.G. of simple regular solids- cube, cylinder, cone, sphere, hemisphere 6.4 Determination of C.G. of composite solid composed of not more than two regular solids

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Fundamental Concepts	02	04	---	---	04
II	Simple lifting machine	12	02	04	06	12
III	Resolution and composition of coplanar forces	14	04	08	06	18
IV	Equilibrium of coplanar forces	14	04	06	08	18
V	Friction	12	04	04	08	16
VI	Centroid and center of gravity	10	02	04	06	12
	Total	**64**	**20**	**26**	**34**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIMENTS/ TUTORIALS :

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
	Practical performance on any three lifting machines from 1 to 5		
1	II	Use differential axle and wheel to establish law of machine and find maximum efficiency	04
2	II	Use simple screw jack to establish law of machine and find maximum efficiency	04
3	II	Use single or double purchase crab to establish law of machine and find maximum efficiency	04
4	II	Use two sheave or three sheave pulley block to establish law of machine and find maximum efficiency	04
5	II	Use Weston's differential pulley to establish law of machine and find maximum efficiency	04
6	III	Use force table to determine resultant of coplanar concurrent force system applying law of polygon of forces	04

7	III	Use law of moment apparatus to determine unknown forces.	02
8	IV	Use force table to find unknown forces by applying Lami's theorem.	02
9	IV	Use beam reaction apparatus to check equilibrium of parallel forces.	02
10	V	Use friction apparatus to determine coefficient of friction for motion on horizontal plane (for two pairs of different contact surfaces)	04
11	V	Use friction apparatus to determine coefficient of friction for motion on incline plane (for two pairs of different contact surfaces)	04
12	VI	Determine centroid of geometrical plane figures	02
TOTAL			**32**

8. SUGGESTED STUDENTS ACTIVITIES:

Other than class room and laboratory activities following are the suggested co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences.

SR. NO.	ACTIVITY
1	Collect photographs of concurrent ,Parallel, general force system in equilibrium
2	Illustrate practical situations where friction is essential and not essential
3	For given situations(three) suggest appropriate simple lifting machine
4	Collect photographs where hinge, roller and fixed supports are used.
5	Prepare model of irregular geometrical figure and locate it's centroid

.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES:

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-

b. Q & A technique.

c. Demonstration.

d. Activity based learning.

f. Use of video, animation films to explain concepts, facts and applications of mechanics.

10. SUGGESTED LEARNING RESOURCE:

S.No.	Name of Book	Author	Publication
1	Applied Mechanics	R. S. Khurmi	Dhanpat Rai & Sons, Delhi.
2	Engineering Mechanics	S. S. Bhavikatti	I. K. International Publishing House Pvt. Ltd., New Delhi
3	Engineering Mechanics (Static and Dynamics)	A. Nelson	Tata McGraw Hill Co., Delhi.
4	Fundamental of Applied Mechanics (SI Version)	Dadhe, Jamdar, Walavalkar	Sarita Prakashan, Pune
5	Engineering Mechanics	Dr.S. M. Dumne	Nikita Publication, Latur.
6	Engineering Mechanics	Dr.Abhishek Jain	Invincible Publishers
7	Engineering Mechanics	Dr.R.K.Bansal	Laxmi Publication,ISBN-978-81-318-0078-2

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr. No.	Name of equipment	Brief specification
1	Universal Force Table	A circular 40 cm diameter aluminum disc, graduated into 360 degrees. Leveling screws clamping devices to fix the table to desired angle, six sliding clamp pulleys, control ring, string and six sets of iron nickel slotted weigh
2	Law of moment apparatus	A stainless steel graduated beam 12.5 mm square in section, 1m long, pivoted at center. The top of beam is provided with notches at the interval of 10mm for carrying hanger weights with spirit bubble level tube

		with necessary slotted weights, hanger
3	Beam reaction apparatus	Two circular dial type 10 kg, extension spring balances or tube in tube type. Complete with suitable stands, a wooden beam with scale and slots at regular intervals, four stirrups with hooks and necessary slotted weights, hanger
4	Friction apparatus	Base to which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees. A 5 cm diameter friction less pulley is attached to the end by means of a clamp adjustable to any necessary position. Two weight boxes 01 of 5 gm,01 of 10 gm, 02 of 20 gm, 02 of 50 gm, 02 of 100 gm weight, Boxes each weighing 300 gm with 8 mm ply case and bottom of different surfaces.
5	Simple screw jack	Screw of pitch of 5mm carrying a double flanged turn table 20 cm diameter fitted on steel base and two adjustable pulleys, cords and hooks.
6	Worm and worm wheel	Threaded spindle, load drum, effort wheel; necessary slotted weights, hanger and thread
7	Weston's differential pulley	Two pulleys; one bigger and other smaller. Both pulleys are rigidly fixed to each other with same center and mounted on same shaft. They have cogs around periphery and having continuous chain passing around these pulleys along with snatch block.
8	Differential axle and wheel	A wheel of 40 cm diameter and axles are of different diameter 20 cm and 10 cm giving a ratio of 1:2:4 ; with common axis and supported on ball bearings in iron brackets, necessary slotted weights, hanger and thread.
9	Single purchase winch crab	Effort wheel of C.I. material having 25 cm diameter mounted on a shaft of about 40mm diameter on the same shaft, a geared wheel of 15 cm diameter is mounted. The teeth of pinion wheel shall mesh with spur toothed wheel of 30 cm diameter is mounted on another axle to which load drum of about 7.5 cm diameter, necessary slotted weights, hanger and

		thread)
10	Double purchase winch crab	A winch having assembly same as that of single purchase crab winch except an additional set of gearing arrangement.
11	Two sheave and three sheave pulley blocks	Double sheave pulley blocks of diameter 65-205 mm,ropediameter10-40 mm and carrying maximum safe working load 500kg Triple sheave pulley blocks of diameter 65-205 mm,rope diameter 10-40 mm and carrying maximum safe load 3600kg

12. LEARNING WEBSITE & SOFTWARE:

i. www.youtube.com(www.youtube.com/watch?v=TkXAJHitPAY, www.youtube.com/channel/UChqgQknjcmAsjosqac1uLqA, www.youtube.com/watch?v=4VIhh6sGkrI,www.youtube.com/watch?v=r3Ru1zZjvu, www.youtube.com/watch?v=Vs3XfnhyGHc)forvideosregarding simple lifting machines and friction
ii. www.nptel.ac.in:for learning materials with audio and video in technical education
iii. www.discoveryforengineers.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs) :

Sr. No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Classify the given force system.	3	2	1	1	-	-	-	-	-	-	-	-
2	Select the appropriate simple lifting machines for given situations.	2	2	3	2	-	-	-	-	-	-	-	-
3	Check the stability of engineering systems by applying force equilibrium conditions	2	3	2	1	-	-	-	-	-	-	-	-
4	Use principles of friction to analyze equilibrium of rigid bodies/simple structures for common	2	3	2	1	-	-	-	-	-	-	-	-

	engineering situations.												
5	Locate the Centroid and Centre of gravity of components of engineering systems.	2	2	3	2	-	-	-	-	-	-	-	-

Course Curriculum Design Committee:

Sr No	**Name of the faculty members**	**Designation and Institute**
1	Madhuri Ganorkar	Head of Applied Mechanics Department, Govt. Polytechnic, Aurangabad
2	Ganesh Kechkar	Lecturer in Applied Mechanics, Govt. Polytechnic, Aurangabad
3	Rajesh Aghav	Lecturer in Applied Mechanics, Govt. Polytechnic, Aurangabad
4	Dr.Shivaji Dumne	Lecturer in Applied Mechanics, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ENGINEERING MATHEMATICS**

COURSE CODE **6G102**

Diploma program in which course is offered	Semester in which course is offered
CE/ME/EE/ET/IT/CO/AE	Second Semester

1. RATIONALE:

Engineering Mathematics forms foundation to understand basic principles of Engineering Mathematics to solve engineering problems. This subject is an extension of Basic Mathematics which deals with calculus, differentiation, integration, differential equations etc. which have applications in several engineering courses of various programmes. This course aims at multi-dimensional logical thinking and reasoning capabilities of the students.

2.COMPETENCY STATEMENT:

At the end of studying this course students will be able to

"Solve engineering problems using the principles of applied mathematics."

3. COURSE OUTCOMES

Students will be able to

1. Differentiate the various function using different rules
2. Apply rules of derivatives to solve engineering problems.
3. Apply rules of integration to solve engineering problems.
4. Solve the various types of differential equations.
5. Apply principles of central tendencies for quality assurance in engineering field

4. TEACHING AND EXAMINATION SCHEME

Teaching scheme (In hours)			**Total credits (L+T+P)**	**Examination scheme**				
				Theory Marks		**Practical marks**		**Total Marks**
L	**T**	**P**	**C**	**ESE**	**PT**	**ESE**	**PA**	
03	01	00	04	80	20	--	--	100
Exam Duration				3 Hrs	1 Hr.			

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

5. CORSE DETAIL:

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT -I Derivatives	1a.Differentiate various engineering functions	1.1 Definition of derivative, notation. 1.2 Derivative of standard functions. 1.3 Rules of Differentiation (without proof) such as sum, difference, product and quotient. 1.4 Derivative of composite functions. 1.5 Derivative of inverse trigonometric functions. 1.6 Derivative of implicit functions. 1.7 Derivative of parametric functions. 1.8 Logarithmic differentiation. 1.9 Second order derivatives.
UNIT- II Applications of derivative	2a.Apply derivatives to find Velocity, Acceleration and Maxima & Minima	2.1 Tangent & normal. 2.2 Maxima & minima. 2.3 Radius of curvature.
UNIT -III Integration	3a.Integrate various Functions using appropriate methods.	3.1 Definition of integration. 3.2 Integration of standard function. 3.3 Rules of Integration: sum, difference & multiplication. 3.4 Methods of Integration 3.4.1 Integration by substitution. 3.4.2 Integration by partial fraction. 3.4.3 Integration by parts. 3.5 Definition of Definite integral. 3.6 Simple problems on definite integral
UNIT- IV Differential Equations	4a.Solve various types of differential equations.	4.1 Definition of differential equation, order &degree. 4.2 Formation of differential equation. 4.3 Solution of Diff. equation. 4.4.1 variable separable. 4.4.2 Homogeneous equation. 4.4.3 Exact diff. equation. 4.4.4 Linear diff. equation.
UNIT -V Statistics	5a.Measure Central Tendencies 5b. Measure Dispersion for given data.	5.1 Graphical representation: Histogram & o-give curve to find Mode and median. 5.2 Measures of dispersion : Range, mean deviation and Standard deviation.

6. SUGGESTED SPRCIFICATION TABLE WITH HOURS AND MARKS

Sr, No	Title/Topic	Teaching Hours	Distribution of Theory Marks			
			Remembrance levels	Understanding levels	Application levels	Total
1	Derivative	12	2	08	08	18
2	Applications of derivative	04	00	04	08	12
3	Integration	16	06	08	12	26
4	Differential Equations	10	04	04	08	16
5	Statistics	06	02	02	04	08
TOTAL		48	14	26	40	80

(THEORY)

7. SUGGESTED LIST OF TUTORIAL

1) The exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency
2) Form a batch of 20 students and at least **ten** problems should be given to get necessary exercise.
3) Course faculty will provide programme related problems.

Sr. No.	**Title/Topic**	**Exercises/Tutorial**	**Approx. hours**
1	Derivative	Solve problems related to various methods/techniques of differentiations	03
2	Applications of derivative	Calculate Engineering Applications of Tangent, normal, maxima, minima and Radius of curvature from respective programmes.	03
3	Integration	Solve problems Related to Various Methods/Techniques of integration	04
4	Differential Equations	Solve problems Related to Various Methods/Techniques of Differential equation.	04
5	Statistics	Solve examples of Comparative data. Plot different types of graph.	02

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

Other than the classroom learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect the mathematical derivation based on curriculum from respective programme.
b. Identify mathematical problems related to respective programme and get them solved.
c. Find graphical software using internet and list them.
d. Identify problems based on applications of differential equations and solve these problems.
e. Prepare a seminar on any relevant topic based on curriculum.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course

a. Use open resources available on internet to teach Engineering Mathematics.
b. Apply the mathematical concepts learnt in this course to branch specific problems.
c. Use different instructional strategies in classroom teaching.

10. SUGGESTED LEARNING RESOURCES

Sr. No.	Title	Author	Publication
1.	Mathematics for polytechnic students for second Year	S. P. Deshpande	Pune vidhyarti gruh prakshan Pune
2.	Applied Mathematics	By Patel & Rawal	Nirali prakashan Mumbai
3	Mathematics for polytechnic students for second year	G.V.Kumbhojkar	Phadke prakashan Kholapur

11. MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS

Sr. No.	Name of the Equipment	Specification
1	NA	

12 . SOFTWARE/LEARNING WEBSITES

---

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Students will be able to differentiate the various function using different rules	2	3	1	-	-	-	-	-	-	-	-	-
CO2	Students will be able to apply the differentiation to Velocity, Acceleration and Maxima & Minima	-	-	1	-	1	-	-	-	-	-	-	-
CO3	Students will be able to so Integrate the various Function using different methods	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Students will be able to solve the various types of differential equation using different methods.	1	1	3	-	-	-	-	-	-	-	-	-
CO5	Students will be able to Measure Central tendency and Measure Dispersion in given data	-	1	1	-	1	-	-	-	-	-	-	-

COURSE CURRICULUM DEVELOPMENT COMMITTEE

Sr. No.	Name of the faculty member	Designation and Institute
1	Mr. M.A. Ali	Lecturer in Mathematics, Government Polytechnic, Aurangabad
2	Mr. R.B. Borulkar	Lecturer in Mathematics, Government Polytechnic, Aurangabad
3	Mrs. H.H. Bhumkar	Lecturer in Mathematics, Government Polytechnic, Aurangabad

Member Secretary PBOS | Chairman PBOS | Co-ordinator science and Humanities

COURSE TITLE **COMMUNICATION SKILLS**
COURSE CODE **6G302**

Diploma Programme in which this course is offered	Semester in which offered
All Branches of Diploma in Engineering and Technology	Second Semester

1. RATIONALE

Proficiency in communication skills is one of the prime needs of diploma engineer/ technician who has to communicate all the time with peers, superiors, sub-ordinates and clients in his professional life. The need of acquiring effective communication skills is more essential. As the world is shrinking into a global village with the new technologies, technically sound diploma holders may be a quality human resource, if their communicative abilities are shaped properly. Therefore, this course is designed to develop the ability of students to stand as a skilled and effective communicator with employability skills.

2. COMPETENCY

At the end of studying this course students will be able to

"Communicate effectively at workplaces."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**ESE**	**PT**	**ESE(OR)**	PA	TOTAL MARKS
1	-	2	3	-	-	25@	50	75
Exam Duration				-	-	-	-	

(*): *Out of 50 marks, 10 marks -micro-project assessment; 40 marks-progressive assessments*
Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Test; OR-Oral examination

4. COURSE OUTCOMES

1. Express new ideas effectively.
2. Select suitable type of communication in different situations.
3. Avoid communication barriers for effective communication.
4. Use appropriate body language to communicate effectively.
5. Formulate various ways to face interview effectively.
6. Draft different types of business letters, notices, memoranda and E-mails using correct formats.

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT-I Introduction to communication	1a. Describe significance of Communication. 1b. Describe the elements of communication. 1c. Explain the cycle & process of communication. 1d. Identify the various communication situations.	1.1. Definition, importance 1.2. Communication cycle / process 1.3. Elements of Communication
UNIT-II Types of communication	2a.Identify the types of communication. 2b.Explain the types of communication.	2.1. Verbal-nonverbal , formal-informal, upward-downward, horizontal-diagonal communication
UNIT -III Principles of effective communication	3a.Explain the principles of communication. 3b.Illustrate principles of effective communication. 3c. Describe communication barriers. 3d. Identify the types of communication barriers. 3e. Select ways to overcome communication barriers.	3.1.Effective Communication 3.2.Barriers to communication & ways to overcome them
UNIT-IV Non -Verbal Communication	4a. Understanding non-verbal communication. 4b. Know the uses of body language. 4c. Uses of pictorial representations.	4.1.Non-verbal codes 4.2.Aspects of body language 4.3. Pictorial representation
UNIT –V Interview Techniques	5a. Listening& comprehending the passage. 5b. Having presence of mind. 5c. Managing stress. 5d. Facing viva.	5.1.Listening skills 5.2.Stress management 5.3.facing oral communication
UNIT-VI Formal Written Skills	6a. Correct format with correct language. 6b. Identify the types of letters. 6c.Applying different techniques of drafting reports.	6.1.Business Letters: Enquiry, Order, Complaint, Adjustment, Seeking Permission etc. 6.2 Report writing.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Communication	03	NA	NA	NA	NA
II	Types of communication	02	NA	NA	NA	NA
III	Principles of Effective Communication	03	NA	NA	NA	NA
IV	Non-verbal communication	03	NA	NA	NA	NA
V	Interview Techniques	02	NA	NA	NA	NA
VI	Formal written skills	03	NA	NA	NA	NA
	Total	16	NA	NA	NA	NA

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psycho-motor and affective domain)** so that students are able to acquire the competencies.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Identify the elements of communication cycle with two suitable examples.	02
	II	Identify the types of communication with two suitable examples.	02
2	II	Deliver a prepared speech.	02
	II	Deliver an extempore speech.	02
3	III	Present a role-play in a group.	02
	III	Present a role-play individually.	02
4	III	Present a group discussion on current issues and summarize it.	02
	III	Present a debate on a given topic.	02
5	II&IV	Prepare a power point presentation on any one technical topic.	02
	II&IV	Prepare a power point presentation on any	02

		one non-technical topic.	
6	III	Demonstrate any assigned activity using appropriate body language.	02
	III	Demonstrate any self activity using appropriate body language.	02
7	III	Self introduction for an interview.	02
	III	Face a mock-interview.	02
8	IV	Write a job application letter in an appropriate format.	02
	IV	Draft a report on a given topic.	02
Total			**32**

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities:

a. List the different communication situations.
b. Use audio visual aids to learn different skills in communication.
c. Conversations –formal/informal.
d. Read newspaper.
e. Collect different audio clips.
f. SWOT analysis.
g. Deliver welcome/farewell speeches in various programmes.
h. Use of graphics in technical writings.
i. Interviewing common people.
j. Debating practices.
k. Summarizing discussions.
l. Practicing interviews

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

a. Arrange various debate/elocution competitions to develop spoken communication skills.
b. Show audio/video clips to develop listening skills.
c. Collect various pictures/charts to demonstrate body language.
d. Prepare and give oral presentations.
e. Guide micro-projects in groups as well as individually.

10. SUGGESTED TITLES OF MICRO PROJECTS

A micro-project is planned to be undertaken by a student. He/she ought to submit it by the end of the semester to develop the industry oriented COs. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty**:**

a. Find out five communication events from day to day life and explain them in the form of communication process.
b. Find out various reasons of communication gap in certain official situations.

c. Identify various types of communication situations in student's life.
d. Study various barriers occurring in communication among diploma students.
e. Find out the remedies to overcome psychological barriers in communication.
f. Collect different types of letters and analyze the language and format used in it.
g. Prepare a review on the listened story/news/discussion/meeting.

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1.	Business Communication	R.C.Bhatiya	Ane Books India, New Delhi.
2.	Developing Communication Skills	Krishna Mohan& Meera Banerjee	Macmillan
3.	Power Point Presentation	Adam B Cooper	Macmillan
4.	Group Discussions & Interviews	Dr.B.R.Kishor& D. S.Paul	Vee Kumar
5.	Body Language	Allan Pease	Sheldon Press, London.

12.MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS

Sr.No.	Name of the Equipment	Specification
1	Digital English Language Laboratory	
2	Computers and Headphones	
3	Magazines,Articles,Journals in Lab.	

13. E-LEARNING RESOURCES

(Please mention complete URL of the E- resourses CO wise)

1	https://www.nptel.ac.in/courses
2	https://www.k12reader.com
3.	https://www.eduaction.com
4.	https://www.k5learning.com
5.	https://www.english4u.com

POs and PSOs assignment and its strength of assignment with each CO of the Course -

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Develop the habit to express new ideas properly.	1	1	3	-	1	-	-	-	1	1	-	-
CO2	Select correct type of communication in different situations.	-	-	1	-	1	-	1	1	1	1	-	-
CO3	Avoid communication barriers for effective communication.	-	-	2	-	2	2	2	2	2	2	-	-
CO4	Use appropriate body language to communicate effectively	-	-	1	-	2	2	2	3	3	3	-	-
CO5	Formulate various ways to face interview effectively.	-	-	2	-	3	2	2	3	3	3	-	-
CO6	Draft different types of business letters, notices, memoranda and E-mails using correct formats.	-	-	1	-	1	-	-	1	1	1	-	-

Course Curriculum Design Committee:

Sr. No	Name of the faculty member	Designation and Institute
1	Mrs. P.Y. Kamble	Lecturer in English, Government Polytechnic, Aurangabad
2	Mrs. M.S. Ban	Lecturer in English, Government Polytechnic, Aurangabad
3	Mr. P.V. Deshmukh	Lecturer in English, Government Polytechnic, Aurangabad
4	Mr. R.L. Korde	Lecturer in English, Government Polytechnic, Aurangabad
5	Mr. D.D. Gangthade	Lecturer in English, Government Polytechnic, Aurangabad
6	Mr. A.P. Jagtap	Lecturer in English, Government Polytechnic, Osmanabad

Member Secretary PBOS Chairman PBOS Co-coordinator science and Humanities

COURSE TITLE **ENGINEERING DRAWING**

COURSE CODE **6R201**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	**Semester in which offered**
Mechanical, Automobile	Second

1. RATIONALE

Engineering Drawing is the language of an engineers and technicians. Always the engineers come across different types of drawings. It is therefore very important to understand the concepts involved in drawing. The course aims at developing the ability to draw and read projections of lines/planes/solids and develops imagination and translating skills in drawing orthographic sectional and missing views of common engineering components.
It covers knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian standards.

2. COMPETENCY

At the end of studying this course students will be able to

"Prepare engineering drawings with given geometrical dimensions using prevailing drawing standards and drafting instruments.''

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR)	PA (TW)	100
2	-	4	6	--	--	50#	50	
Duration of the Examination (Hrs)				--	--	2hrs.	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P**- Practical**; C**- Credits**; ESE**- End Semester Examination**; PT – Progressive Test, PA**- Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Draw orthographic views of objects.
2. Draw sectional views of objects.
3. Draw isometric views and missing view
4. Draw projections of 2D and 3D standard regular entities.
5. Draw sectional views of 3D standard solids.
6. Use various drawing codes, conventions and symbols as per IS SP-46.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Orthographic and sectional views	1a.Draw the orthographic views of object. 1b.Draw sectional orthographic views of object.	Using **First Angle** Projection Method only. 1.1 Review of orthographic projections 1.2 Conversion of pictorial view into Orthographic views. 1.3 Sectional orthographic views.
Unit - II Isometric projections	2a.Draw the isometric view from orthographic views. 2b.Use isometric scale to draw isometric projections.	2.1 Introduction 2.2 Isometric scale and its use 2.3 Conversion of orthographic views into isometric view / projection (Including rectangular, cylindrical objects, representation of slots on sloping as well as plane surfaces)
Unit - III Projections of Lines and Planes	3a.Draw the projection of points, lines and planes with different orientations. 3b. Find out true shape and size of a inclined line or plane.	Using First Angle Projection Method only. 3.1 Projection of points. 3.2 Projection of Lines inclined to **one** reference plane only. 3.3 Projection of Planes inclined to **one** reference plane only.

Unit - IV Projection of solids	4a.Identify center, apex, corners, lines, surfaces and slant edges of regular solids. 4b.Draw the projection of Solids with different orientations.	Projection of following solids with their axes inclined to one reference plane only. (Use of first angle method of projections). 4.1 Prism and pyramids: Triangular, Square, Pentagonal and Hexagonal types. 4.2 Cylinder 4.3 Cones.
Unit - V Section of solids	5a.Draw the projection of sections of solids with different conditions and positions. 5b.Find out true shape and size of an inclined solid.	Use **First angle** projection method only. Axis of cutting plane inclined to one reference plane and parallel to other reference plane. Axis of solid perpendicular to one reference plane only. 5.1 Sectional views of solids such as Prism, pyramid, cone and cylinder

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit	Unit Title	Teaching Hours	Distribution of practical exam. Marks			
			R Level	U Level	A Level	Total Marks
I	Orthographic and sectional views	8	2	4	6	12
II	Isometric projections	6	2	4	4	10
III	Projections of Lines and Planes.	8	2	4	6	12
IV	Projection of solids	6	-	4	4	8
V	Section of solids	4	-	4	4	8
Total		**32**	**6**	**20**	**24**	**50**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are

able to acquire the competencies/ programme outcomes. A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

Sr. No.	Unit Number	Practical Exercises	Hrs. required
1	I	1.1 One sheet on Orthographic projections of a given object (2 problems) 1.2 One sheet on Sectional Orthographic projections of a given object(2 problems) 1.3 practice problems in sketch book on above	8 8
2	II	2.1 One sheet on Isometric projection (2 problems) and practice problems in sketch book	10
3	III	3.1 One sheet on projection of lines & planes. (2+2 problems) and practice problems in sketch book	8
4	IV	4.1 One sheet on projection of solids (2 problems) and practice problems in sketch book	10
5	V	5.1 One sheet on projection of sections of solids. (2 problems) and practice problems in sketch book	10
6	I	Redraw orthographic projection sheet using AutoCAD.	10
Total			**64**

Notes:

a. Use one sides of sheet.

b: Theory & practice should be in first angle projections and IS codes should be followed wherever applicable.

c: The dimensions of line, axes, distances, angle, side of polygon, diameter, etc. may be different for different batches.

d: The sketchbook has to contain data of all problems, solutions of all problems and student activities performed. Students' activities are compulsory to be performed.

e: A hand out containing applicable standards from IS codes including title block as per IS standard should be given to each student by concerned teacher.

f: For 50 marks Practical Marks ESE, students are to be assessed for competencies achieved. Students are to be given data for practical ESE to prepare drawings.

AUTO-CAD Work: In a few practical hours students should be made conversant with auto cad 2D and 3D regular solid drawings. Simple drawings should be demonstrated to the class with use of LCD projector

One sheet on orthographic projections should be redrawn by using AUTO-CAD and its Print out A4 size should be attached in sketch book by all students.

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

Sr. No.	Activities
1	Draw free hand isometric views of any components. Also draw orthographic projections of them (all views).
2	Prepare models of planes, solids of cardboard, sheets. Position it with reference to principle planes.
3	Draw simple 2D and 3D with AutoCAD.
4	List points, apex, center line, slant edges of different standard solid models available in laboratory.
5	Students should collect Production drawings, Layouts from nearby workshops/industries and visualize the part from the given views.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

Sr. no.	Unit no	Unit name	Strategy
1	I	Orthographic and sectional views	Conventional black board method, Use of models. Use of software.
2	II	Isometric projections	Conventional black board method, Use of models.
3	III	Projections of Lines and	Planes made of sheet, cardboard.

		Planes	
4	IV	Projection of solids	models
5	V	Section of solids	Models cut section

10 .SUGGESTED LEARNING RESOURCE

Sr No	Title of Book	Author and Publication
1	Elementary Engineering Drawing	N.D.Bhatt , Charotar Publishing House
2	Engineering Drawing	Mali , Chaudhari, Vrinda Publication
3	Engineering Drawing	Sidheswar Shastri , Tata Mc Graw Hill
4	Engineering Drawing	Arunoday kumar, Techmax publications, Pune.
5	Engineering Drawing for schools and colleges	IS CODE SP- 46

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr.No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Models- full and cut. (wooden and acrylic)	12
2	Drawing equipments and instruments for class room teaching-large size.	1
3	Drawing board-half imperial size.	100
4	T-square or drafter (Drafting Machine).	1
5	Auto-Cad software	1

12. LEARNING WEBSITE & SOFTWARE

a) http://www.slideshare.net/sahilsahil992/conic-section-1819818
b) http://www.technologystudent.com/designpro/drawdex.htm
c) http://www.engineeringdrawing.org/engg_curves/problem-3-8-engineering-curves/490/
d) http://web.iitd.ac.in/~hirani/mel110-part3.pdf
e) http://www.studyvilla.com/ed.aspx
f) http://www.youtube.com/watch?v=a703_xNeDao
g) E-learning package from KOROS.
h) E-learning package from Cognifront

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Draw orthographic views of objects.	1	3	3	1	-	-	-	3	1	-	2	2
CO2	Draw sectional views of objects.	1	3	3	1	-	-	-	3	1	-	1	2
CO3	Draw isometric views and missing view	1	3	3	1	-	-	-	3	1	-	1	2
CO4	Draw projections of 2D and 3D standard regular entities.	1	3	3	-	-	-	-	3	1	-	-	1
CO5	Draw sectional views of 3D standard solids.	1	3	3	1	-	-	-	3	1	-	-	1
CO6	Use various drawing codes, conventions and symbols as per IS SP-46.	1	2	2	-	-	-	-	2	1	-	-	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Aher S. M.	Lecturer in Mechanical Engineering, Govt.Polytechnic,Aurangabad
2	Dhirbassi G. D	Lecturer in Mechanical Engineering, Govt.Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

NON EXAM: 6G311 TO 6G328

Course Structure:

Teaching Scheme		**Evaluation Scheme**						
TH	0		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks						
TOTAL	02	Duration						

(LIST OF NON EXAM COURSES)

6G311	Personality Development
6G312	Entrepreneurship Development(CE)
6G313	Hobby Electronics
6G314	Spoken English
6G315	German
6G316	French
6G317	Yoga
6G318	Music instrumental
6G319	Two wheeler maintenance
6G320	Entrepreneurship Development(EE)
6G321	Electrical maintenance
6G322	Electronic maintenance
6G323	Computer Hardware Maintenance
6G324	Japanese
6G325	Music vocal
6G326	aerobics
6G327	Indian classical Dance
6G328	Sewing machine maintenance

COURSE TITLE **MECHANICAL TECHNOLOGY**

COURSE CODE **6M204**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Second

1. RATIONALE

Diploma engineers are always involved in the application of engineering processes in the manufacturing areas. In view of this, it is essential that the diploma engineers should be well exposed to the fundamental processes called non chip forming processes like welding, cold working, hot working, press work, pattern making and foundry processes. Mechanical engineer should be able to visualize these processes in the field of engineering.

2. COMPETENCY

At the end of studying this course students will be able to

"Produce different components using non chip forming process."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	150
3	-	3	6	80	20	--	50	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studing this course students will be able to: -

1) Prepare pattern considering different allowances
2) Produce simple castings by using sand moulds.
3) Prepare simple components by press operations
4) Perform welding operation by using relevant parameters.
5) Follow safety precautions.

5. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics and Sub-Topics
Unit - I Pattern Making	1a. Describe the constructions of pattern 1b. Prepare pattern layouts 1c. Use of different allowances. 1d. Apply colour codes.	1.1 Definition, Design consideration in pattern, pattern layout, pattern construction, 1.2 Pattern materials, selection of materials; Allowances, master pattern, function, types, core prints unserviceable parts as pattern; core boxes 1.3 Color code and preservation of pattern. Shrinkage / contraction Rule.
Unit - II Moulding	2a. Describe different moulding machine 2b. Identify the Characteristics of moulding sand 2c. Describe testing of moulding sand 2d. Write functions of gating system	2.1 Hand tools, and their uses, 2.2 Moulding machines and their types, 2.3 Moulding sand, characteristics, constituents of moulding sand, sand preparation & conditioning, sand testing equipments, core moulding, and solidification of metals. 2.4 CO_2 moulding. 2.5 Moulding procedure, gating, rising, use of pads, exothermic material, use of chills, chaplets.
Unit - III Foundry Engineering	3a. Describe different types of furnaces. 3b. Explain cupola operation.	3.1 Introduction, furnaces used in foundry like coke fired, gas fired, cupola, 3.2 Preparation of cupola, charging of cupola, jamming of cupola, 3.3 Defects in casting, causes &

	3c. Identify defects in casting 3d. Describe different casting processes.	remedies, inspection of casting, 3.4 Gravity die casting, slush casting, 3.5 Special casting methods, permanent mould, hot chamber die casting m/c, cold chamber 3.6 Die casting m/c, centrifugal casting, true centrifugal, semi centrifugal, and centrifuging, investment casting, continuous casting
Unit - IV Hot and Cold working processes	4a. Describe different hot working processes. 4b. Describe different cold working processes.	4.1 Processes of Hot working: Pipe & tube production, forging, extrusion, piercing, hot spinning. 4.2 Process of cold working: cold rolling, shearing & blanking, wire drawing, spinning, embossing, stretch forging, squeezing, high pressure sheet metal forming.
Unit - V Press and Press work	5a. Describe different types of presses 5b. Identify different parts of power press. 5c. Describe power press driving mechanism	5.1 Introduction, types of presses, 5.2 Power press parts, power press driving mechanism, press size, press tools, 5.3 Methods of punch support, methods of die support, die accessories, types of dies and operations, press guard, Types of press tools, press brake, press operations.
Unit – VI Welding	6a. Classify welding. 6b. Describe welding methods 6c. Select proper welding method for different materials	6.1 Classification of welding, 6.2 Study of welding methods – Arc welding, Gas welding, Resistance welding, Spot welding, butt welding, flash welding, seam welding, projection welding, thermit welding, inert gas arc welding, TIG welding, MIG welding, 6.3 Selection of welding methods for different materials such as cast steel, cast iron, carbon steel, stainless steel.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Pattern Making	6	02	04	08	14
2	Moulding	8	02	04	08	14
3	Foundry Engineering	10	02	06	06	14
4	Hot and Cold working processes	8	02	06	04	12
5	Press and Press work	8	02	04	06	12
6	Welding	8	04	04	06	14
		48	**14**	**28**	**38**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	1	Prepare a Pattern by using various allowances. • Selection of material. • Reading of drawing. • Selection of materials/tools. • Procedure for pattern making.	03 03 03 03
2	2	Prepare a sand mould for simple component. • Selection of material. • Reading of drawing. • Procedure for sand mould.	02 03 03
3	3	Produce sand casting.	08
4	5	Prepare a simple component on press machine. • Selection of material. • Reading of drawing.	02 03 03

		• Manufacturing of the component.	
5	6	Produce a component by using arc welding process. • Reading of drawing. • Cut the raw material as per drawing. • Selection of hand tools/ machines. • Observe the welding defects & interpretation. • Application of proper safety precautions.	 03 03 03 02 01
TOTAL			**48**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Visit to the Foundry shop and observe the Centrifugal/Investment/Die Casting process and identify the different defects on the surface of component.
b. Visit to Industry where the operation like drop forging, rolling & extrusion are carried out. Collect information on types these machines, their specification and observe various activities performed in a these processes and characteristics of output product.
c. Visit to Industry/workshop to observe the process like seam, spot, TIG & MIG welding. Collect information on these machines, their specification and observe these processes critically and get the information regarding various accessories (electrodes, current rating etc.) used in these processes.
d. Collect information of recent advancement in manufacturing processes, machines/tools/equipments and its specifications/manufacturer and application in the industry.
e. Collect information of various forming processes used in industry. Observe shape of input and output product and suggest suitable operation for various jobs.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Workshop Technology Vol. 1	Hajra, Choudhary	Asia Publications Delhi
2	Workshop Technology Vol.1	Raghuwanshi,	Dhanpat rai and sons
3	Production Technology	R.K. Jain,	Khanna Publications
4	Workshop Technology	Chapman (Vol. 1 & Vol. 2) ,	Arnold Publications

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Wood turning lathe ,hand tools	As per Workshop specification
2.	Pit furnace and foundry tools	As per Workshop specification
3	Fly press	As per Workshop specification
4	Arc welding / Gas welding set up	As per Workshop specification

12. LEARNING WEBSITE & SOFTWARE

i. www.nptel.ac.in
ii. http://nptel.iitm.ac.in/video.php?subjectId=112105126
iii. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/pdf/LM-01.pdf
iv. http://www.savetubevideo.com/?v=H0AyVUfl8-k&list=PLEFE7D1579523C45D
v. http://www.savetubevideo.com/?v=FFzRIop5bpg&list=PL843C2A830C65E2EE
vi. http://www.savetubevideo.com/?v=81Fdif5e85c
vii. http://www.savetubevideo.com/?v=A0dTvf_Q8BA&list=PL2C105C94D2955C8B
viii. http://www.savetubevideo.com/?v=tDc0l9Gm8D4&list=PL3AFB507B668AF162
http://www.savetubevideo.com/?v=THVgkBnjLq0
ix. http://www.savetubevideo.com/?v=6VpCBk7FahI
x. http://www.savetubevideo.com/?v=7wC1u4WOV1o
xi. http://www.savetubevideo.com/?v=VDIoUZuTunI
xii. http://www.savetubevideo.com/?v=fGqc9mZS0YI
xiii. http://www.savetubevideo.com/?v=Mn9jpqI8rao

xiv. http://www.savetubevideo.com/?v=8SuoH5aL1SY
xv. http://www.savetubevideo.com/?v=xxNZSQML_ZA
xvi. http://www.savetubevideo.com/?v=XXUHZxweBcw&list=PLD07DE61CB871A0CB

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Prepare pattern considering different allowances.	3	3	3	3	-	-	-	2	-	-	-	3
2	Produce simple castings by using sand moulds.	3	3	3	3	-	-	-	2	-	-	-	3
3	Prepare simple component by press operations	3	3	3	3	-	-	-	2	-	-	-	3
4	Perform welding operation by using relevant parameters.	3	3	3	3	-	-	-	2	-	-	-	3
5	Follow safety precautions.	3	3	3	3	-	-	-	2	-	-	-	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	D.V. Tammewar	Workshop Superintendent,Govt. Polytechnic, Aurangabad
2	S .V Borde	Lecturer in Mechanical Engg. Govt. Polytechnic, Aurangabad.

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **THEORY OF MACHINES**
COURSE CODE **6M206**

PROGRAMME & SEMESTER

Diploma programme in which this course is offered	Semester in which offered
Mechanical	Third

1. RATIONALE:-

This is a basic technology course which primarily focuses on the basic principles of various mechanisms, analysis of motions of the different parts of the machines. The principles of theory of machines are useful in designing the machines. The course also encompasses design of cams, power transmission drives, flywheels and governors.

2. COMPETENCY

"To analyze the motions in different parts of the machines."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	150
3	-	2	5	80	20	--	50	
Duration of the Examination (Hrs)				03	01	--	--	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE**-End Semester Examination; **PT** - Progressive Test; **OR**-Oral examination,~ Online Examination.

4. COURSE OUTCOMES:

At the end of studying this course students will be able to: -

1. Analyze different mechanisms and their inversions.
2. Determine velocity and acceleration quantities for different mechanisms.
3. Draw Cam profiles for given applications
4. Calculate power transmitted by the different drives.

5. Determine the forces required to overcome the friction in bearings.
6. Demonstrate use of flywheel & governor in machineries.

5. DETAILED COURSE CONTENTS

Unit	**Major Learning Outcomes (Cognitive Domain Only)**	**Topics And Sub-Topics**
Unit –I Simple Mechanisms	1a. Identify links in given mechanism 1b. Compare machine with structure. 1c. Identify constrained motions in given kinematic pairs 1d. Explain kinematic chain, mechanism and inversions of different mechanisms. 1e. Select an inversion for a given applications	1.1 Introduction, Kinematic link, Types of links, Concept of Machine and Structure, Difference between machine and structure. Kinematic pairs and types. Types of constrained motions. 1.2 Concept of Kinematic chain, mechanism and Inversion. Inversions of Four bar chain: Beam engine, coupling rod, Watt's indicator mechanism. 1.3 Inversions of Single Slider crank chain: Pendulum pump, oscillating cylinder, Rotary internal combustion engine, Quick return mechanism. 1.4 Inversions of Double slider crank chain: Elliptical trammel, Oldham's coupling.
Unit– II Velocity & Acceleration Diagrams	2a. Apply relative velocity method (Graphical method) for a given mechanism to determine velocity and acceleration 2b. Draw velocity and acceleration diagrams by using instantaneous centre of rotation method. 2c. Draw velocity and acceleration diagrams by using Klein's construction method.	2.1 Relative Velocity method Velocity and acceleration of a point on a link, concept of linear and angular velocity, centripetal and tangential acceleration, angular acceleration. 2.2 Drawing of velocity and acceleration diagrams for simple mechanisms by relative velocity method. 2.3 Instantaneous centre of Rotation (ICR) method: Concept of ICR, Types of Instantaneous centers, Kennedy's theorem, circle diagram to locate Instantaneous centers, finding of velocity of various points by ICR method for Slider crank mechanism and four bar mechanism. 2.4 Klein's construction for velocity and acceleration of piston in slider crank mechanism.

Unit– III Cams & Followers	3a. Differentiate various types of cams & followers 3b. Draw different types of follower motions 3c. Draw cam profiles with respect to different follower motions.	3.1 Definition of cam and follower, types of cams and follower, cam terminology. 3.2 Motions of follower, simple harmonic, uniform velocity, uniform acceleration & retardation, their displacement, velocity & acceleration diagrams. 3.3 Drawing the profiles of cam for given follower and type of motion with offset and without offset.
Unit– IV Power Transmission	4a. Select a drive for a given application 4b. Calculate belt tensions and length of belt for the given set of conditions 4c. Calculate power transmitted by the belt for the given set of conditions. 4d. Select gears for different arrangement of shafts 4e. Determine velocity ratios for simple, compound & epicyclic gear trains.	4.1 Need of power transmission, classification of drives, relative merits and demerits of Belt drives vs Gear drives. 4.2 Belt drives, types of belts, concept of velocity ratio, length of belt, ratio of tensions, initial tension, centrifugal tension, law of belt, comparison of V-belt and flat belt, concept of timing belt. 4.3 Power transmitted by belt drive, condition for maximum power transmission. 4.4 Gears: Gear terminology, types of gears, Gear ratio, spur, helical, bevel, spiral, herringbone, rack and pinion types, and law of gearing. 4.5 Gear trains: Simple, compound and epicyclic gear trains & their velocity ratios. Simple numerical on power transmission and gear trains.
Unit - V Friction In Bearings	5a. Calculate friction power for the given bearing according to uniform pressure & uniform wear condition. 5b. Select a type of bearing for a given situation	5.1 Types of friction, coefficient of friction. 5.2 frictions of pivot and collar bearing, conical bearing with their theories of uniform pressure and uniform wear condition, derivations. Simple numerical on uniform pressure and uniform wear condition.

Unit – VI Flywheel & Governor	6a. Identify flywheel and governor in various machines. 6b. Compare governor with flywheel. 6c. Construct T- **θ** diagram for single and multi cylinder engines to select size of flywheel	6.1 Flywheels: Functions of Flywheel, concept of turning moment (T - **θ**) diagram for four stroke internal combustion engine, multi cylinder engine. 6.2 Fluctuation of energy, coefficient of fluctuation of energy, fluctuation of speed and importance of flywheel in engine and machines. 6.3 Governors: Function of governor, types of governors as centripetal and inertia. 6.4 Governor terminology, comparison with flywheel.
Unit – VII Balancing & Vibrations	7a. Calculate the balancing mass for a given application in a single plane 7b. Identify causes of vibrations in a given machine. 7c. Suggest suitable remedial measures to minimize vibrations.	7.1 Concept of balancing, balancing of single rotating mass. 7.2 Graphical and analytical method for balancing of several masses revolving in same plane. 7.3 Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies, Simple numerical on balancing of several masses revolving in same plane.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Simple mechanisms	08	04	04	04	12
II	Velocity and Acceleration Diagrams	10	02	08	06	16
III	Cams and Followers	08	02	06	04	12
IV	Power Transmission	10	02	08	04	14
V	Friction in Bearings	04	02	04	04	10
VI	Flywheel and Governor	04	00	06	04	10
VII	Balancing and Vibrations	04	00	04	02	06
	Total	**48**	**12**	**40**	**28**	**80**

Legends: *R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	Dismantling & assembly of one each inversion of four bar and single slider crank and double slider crank mechanism.	04
2	I	Determine quick return ratio for quick return mechanism for a given model.	02
3	II	Drawing the Velocity and acceleration diagrams by relative velocity method for simple mechanisms (Two problems)	04
4	II	Drawing the velocity diagram by Instantaneous center method of four bar mechanism.	02
5	II	Draw Klein's constructions to determine velocity and acceleration for a given slider crank mechanism.	02
6	III	Draw cam profile for a knife edge follower and with different type of motions. (01 problem without offset and 01 problem with offset)	04
7	III	Draw cam profile for a roller follower and with different type of motions. (01 problem without offset and 01 problem with offset)	04
8	VI	Determine the radius of rotation of fly-ball for different speed of governor and draw a graph between radius of rotation versus speed.	02
9	VII	Dismantle and assemble a bicycle free wheel sprocket mechanism.	04
10	IV	Determination of Gear ratio for a given gear box and velocity ratio for a given belt drive in the laboratory.	04
		Total	**32**

8. SUGGESTED STUDENT ACTIVITIES

Other than class room and laboratory activities, following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain a report of their experiences which he/ she will submit at the end of the term.

Following is the list of proposed student activities like:

1. Prepare models of different mechanisms to understand motions.
2. Arrange an exhibition of different prototype models of mechanisms.
3. Search for applications of various mechanisms on internet in the machines used in day to day life.
4. Survey of various mechanisms used in material handling devices used in automotive and construction industries.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATEGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning
f. Industrial visits

10. SUGGESTED LEARNING RESOURCES

S.No.	Name of Book	Author	Publication
1	Theory of machines	R. S. Khurmi	S Chand and company
2	Theory of machines	P. L. Ballani	Khanna Publishers
3	Theory of machines	Jagdishlal and Shah	-------
4	Theory of machines	S. S. Ratan	Tata McGraw Hill

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr. No.	Name of equipment	Brief specification
1.	Quick return mechanism	As per specification
2.	Bicycle free wheel mechanism	As per specification
3.	Centrifugal governor	As per specification
4.	Different types of gear drives	As per specification

12. LEARNING WEBSITE & SOFTWARE

a dme-awh.blogspot.com/2012/07/kinematics-with-microstation.html
b www.sciencedirect.com/science/journal/0094114X
c http://nptel.ac.in/courses/112104121/1
d https://www.journals.elsevier.com/mechanism-and-machine-theory
e https://en.wikipedia.org/wiki/Mechanism_(engineering)
f www.erode-sengunthar.ac.in
g https://www.youtube.com/watch?v=fbLl9xMLvl0
h http://www.animatedengines.com/jets.html

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO.No.	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
CO 1	Analyze different mechanisms and their inversions	03	03	-	-	01	-	-	-	-	-	03	-
CO 2	Determine velocity and acceleration quantities for different mechanisms.	02	03	02	-	-	-	02	-	-	-	-	01
CO 3	Draw Cam profiles for given applications	-	03	02	-	-	-	02	-	-	-	-	01
CO 4	Calculate power transmitted by the different drives	-	03	-	-	-	-	-	-	-	-	02	-
CO 5	Determine the forces required to overcome the friction in bearings.	02	03	-	-	-	-	-	-	-	-	-	-
CO 6	Demonstrate use of flywheel & governor in machineries	-	03	-	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee

Sr No	**Name of the faculty members**	**Designation and Institute**
1	V. M. Bukka	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad
2	M. B. Sanap	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad
3	V. B. Kumawat	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE FLUID MECHANICS AND MACHINERY

COURSE CODE 6M401

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Third

1. RATIONALE:-

Knowledge of fluid flow & related machinery is essential in all fields of engineering. Hydraulic machines have important role in power generation, water supply and irrigation and also in most of engineering segments. This course requires knowledge of basic engineering sciences, applied mechanics, mathematics etc. The fundamentals of this course are essential for the course "Industrial Fluid Power".

2. COMPETENCY:-

At the end of studying this course students will be able to

"Understand basic fluid mechanics principles, construction and working principles of hydraulic machines."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
3	-	2	5	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES:-

At the end of studing this course students will be able to: -

1. List basic properties of the fluid.

2. Measure the parameters such as pressure, velocity and flow rate by means of various devices.
3. Calculate major and minor losses in a piping system.
4. Conduct trial on hydraulic machines and draw operating performance curves.
5. Select pumps and turbines for a particular application.
6. Locate faults in pumps and turbines and suggest remedies.

5. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit –I Basics concepts	1a. Correlate physical properties of fluids for specific conditions. 1b. Explain the procedure to measure the pressure of fluid by using manometers and bourdon's gauge for a given situation. 1c. Calculate the pressure head for a given condition	1.1 Mass density, weight density, specific volume, specific gravity, surface tension, capillarity, vapour pressure 1.2 Viscosity - dynamic and kinematics, Newton's law of viscosity. 1.3 Pressure, units, pressure head, Pascal's law, positive and negative pressure. Bourdon's tube, Manometers- piezometer, U-tube, simple differential (Simple Numericals)
Unit– II Fundamentals Of Fluid Flow	2a. Use continuity equation for a given situtaion. 2b. Apply Bernoulli's equation to venturimeter and pitot tube. 2c. Calculate discharge and hydraulic coefficients for a given application.	2.1 Types of flows, concept of discharge, continuity equation 2.2 Energy possessed by the fluid -pressure, kinetic and potential energy 2.3 Bernoulli's equation, assumptions, application of equation in pipes, venturimeter, pitot tube. 2.4 Derivation for discharge through venturimeter, calculation of hydraulic coefficients (simple Numericals)
Unit- III Flow through pipes	3a. Use the laws of fluid friction in a given condition. 3b. Explain different types of losses in pipes and accessories. 3c. Calculate the loss of head for a given application. 3d. Calculate power and efficiency of transmission through pipes.	3.1 Laws of fluid friction, Reynolds number, Major losses, Darcy-Weisbatch equation, Chezy's formula 3.2 Minor losses- entry, exit, sudden enlargement, contraction, bend, valve, elbow 3.3 Hydraulic Gradient Line (HGL), Total Energy Line (TEL) , pipes in series, equivalent pipe, parallel pipes, 3.4 Power transmission through pipes, maximum efficiency of transmission, Water hammer in pipes-causes, effects and remedial measures. (Simple numerical only).

Unit– IV Centrifugal Pumps	4a. Explain the construction and working of centrifugal pump. 4b. Explain the construction and working of submersible pump. 4c. Diagnose faults and suggest the remedies for given situation.	4.1 Application, Construction and working of centrifugal pump, types of casing and impellors,manometricheads,manometricefficiency,overallefficiency,NPSHand.Workdone of centrifugal pump 4.2 Multi-stage pumps, submersible Pumps and jet pumps, cavitation in pumps, Priming of pumps. 4.3 Maintenance, fault finding and their remedies in centrifugal pumps, pump selection (No Numerical)
Unit– V Reciprocating pumps	5a. Explain the construction and working of reciprocating pump. 5b. Understand the use of air vessel. 5c. Diagnose faults and suggest remedies. 5d. Compare reciprocating pump with centrifugal pump.	5.1 Construction, working principle and applications of single and double acting reciprocatingpumps,powerrequirement,indicatordiagram,effect of acceleration and friction in pipes 5.2 Concept of Slip, Negative slip, cavitation and separation 5.3 Use of Air Vessel 5.4 Comparison between Reciprocating pump and centrifugal pump. (No Numerical)
Unit - VI Hydraulic Turbines	6a. Classify the turbines 6b. Explain the working of different types of turbines. 6c. Understand the need. Explain the method of governing.	6.1 Hydraulic power plant layout, classification and application of turbines, 6.2 Construction and working of Pelton wheel, Francis and Kaplan turbine. 6.3 Draft tubes - types and construction, cavitations in turbines 6.4 Need and method of governing of turbines. Selection of turbines. (No Numerical)

6. SUGGESTED SPECIFICATION TABLE WITH QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic concepts	06	02	06	04	12
II	Fundamentals of fluid flow	08	02	04	06	12
III	Flow through pipes	08	04	08	06	18
IV	Centrifugal pumps	10	02	08	04	14
V	Reciprocating pumps	08	02	06	04	12

VI	Hydraulic turbines	08	02	06	04	12
	Total	**48**	**14**	**38**	**28**	**80**

Legends: *R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr.No.	UnitNo.	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	To find out mass density, weight density, and specific gravity of liquids and compare them.	02
2	I	To study different types of manometers and gauges used in the laboratories.	02
3	I	Calculation of pressure with the help of manometers.	02
4	II	Calculation of actual discharge on orifice meter	02
5	II	To measure the flow by using venturimeter.	02
6	III	To determine loss of head per unit length of pipes for different materials.	04
7	III	To determine minor losses of head in pipe joints.	04
8	VI	Study of layout for a hydroelectric power station.	04
9	IV	To find efficiency of a centrifugal pump.	04
10	V	To find efficiency of a reciprocating pump.	04
11	VI	Study and demonstrating working of turbines.	02
		TOTAL	32

8. SUGGESTED STUDENT ACTIVITIES

1. Prepare journals based on practical's performed in laboratory.
2. Make a list of manufacturers of various hydraulic machines through internet search.
3. Visit any two industries manufacturing different types of pumps and prepare a report.
4. List any five companies manufacturing pumps and turbines.
5. Visit the hydroelectric power station and make a report.

6. Search online PPT's, PDF's and video's on the various hydraulic machines.
7. Collect the brochures of different types of submersible pumps
8. Dissemble a centrifugal pump and enlist the components. Write the procedure.
9. Collect the information about troubleshooting procedure of pumps.
10. Collect the information of manufacture of multistage pumps.

9. SPECIAL SPECIFIC INSTRUCTIONAL STRATEGIES (if any)

a. Arrange visits to industries manufacturing different types of pumps.
b. Motivate students to use internet and collect information of any five hydroelectric power stations.
c. Arrange expert lecture on various topics of Hydroelectric Power generation.

10.SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Fluid mechanics and Hydraulic machinery	R. K. Bansal	Laxmi Publications (P) Ltd.
2	Hydraulics	R. S. Khurmi	S. Chand and Company
3	Hydraulics	JagdishLal	Metropolitan Publication Company Pvt. Limited.
4	Fluid mechanics and Hydraulic machinery	Modi and Seth	Standard Book House, Delhi.

11.MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS

1. CENTRIFUGAL PUMP TEST SETUP

1. Centrifugal Pump: Variable speed 1 HP centrifugal pump of size 25 mm suction x 25 mm delivery to discharge 1.5 LPS flow at 12 mtr head.
2. Sump Unit : M.S. C.R.C. sheet metal sump of size 900 mm x 450 mm x 350 mm with inside fiber lamination and drain plug.
3. Flow Measurement Unit : M.S. C.R.C. sheet metal measuring tank of size 500 mm x 350 mm x 450 mm with swinging hopper and fiber lamination from inside. A piezometer level gauge & scale fitting are fitted on measuring tank for discharge measurement.
4. Prime Mover Unit : 1 HP single phase 240 Volt excitation D.C. motor with rigid coupling.
5. Suction & Delivery Piping and fittings are provided with Pressure gauge and vacuum gauge
6. Control Panel Unit : Digital Speed Indicator with speed sensor, On-Off Cam Switch, Energy

meter for Input power measurement, 0 - 230 V., Single phase Auto transformer.
7. Whole unit is fitted on strong and sturdy supporting stand with appreciate color combination powder coating

2. RECIPROCATING PUMP TEST RIG

1. Reciprocating Pump: Size 1" x ¾ " to discharge 60 LPM at 40 meter total head on rated working speed. 1H.P. capacity Pump Test rig set up suitable for pump test at different speeds against different heads. 2. Variable speed 1 H.P. capacity D.C. motor with arrangement of quick alteration of speed.
3. Reservoir of size 0.9 m length x 0.55 m width x0.45 m height with gauge glass & scale fitting, drain valve of ½ " size & a bend. M.S. collecting as well as measuring tank of size 0.6 m length x 0.35 m width x 0.45 m height with bypass arrangement & drain valve of 1" size.
4. A gauge glass & scale fitting are fitted on measuring tank.
5. Pressure gauge and Vacuum Gauge is mounted on delivery line and Suction line respectively for measurement of delivery head and suction head.
6. Control Panel consists of Energy meter, switch, Speed Controller & digital speed indicator.
7. Strong iron-stand to support the unit. Entire unit is powder coated with good color combination.

3. PELTON TURBINE TEST SETUP

1. Turbine Unit :Pelton wheel turbine test rig developing about 1000 watts power at 2.5 bar pressure and 500 LPM discharge. It consists of,
i. Casing : CRC sheet metal casing with transparent window for visualization.
ii. Runner : G.M. runner is fitted with electroplated buckets.
iii. Nozzle & Spear Assembly : Brass designed for smooth flow with stainless steel spear for efficient operation.
2. Centrifugal Pump Unit :
i. Head : 25 mtr.
ii. Discharge : 8 LPS.
iii. Power : 5 H.P.
iv. Speed : 2880 RPM
3. Loading Unit :Turbine is directly coupled to Rope Brake Pulley with drum cooling, Spring balance & dead weights.
4. Flow Measurement Unit :A 2" Venturimeter with without mercury differential manometer.
5. Sump Unit :M.S. C.R.C. sheet metal sump of 500 lit. capacity with inside fiber lamination and drain plug.
6. Suction & Delivery Piping and fittings are provided with Pressure gauge, foot valve & flow control valve.
7. Control Panel Unit : i. Digital Speed Indicator with speed sensor.
ii. Starter Switch with overload relay.
8. Whole unit is fitted on strong and sturdy supporting stand with appreciate color combination.

12. LEARNING WEBSITES AND SOFTWARES

a. http://www.learnengineering.org/2014/01/centrifugal-hydraulic-pumps.html

b. http://www.plant-maintenance.com/articles/centrifugalpumps.pdf

c. http://www.rotechpumps.com/basic-configuration-working-centrifugal-pumps-2

d. https://www.youtube.com/watch?v=BaEHVpKc-1Q

e. http://www.pumpsandsystems.com/topics/pumps/characteristics-centrifugal-pumps-0912

f. https://www.youtube.com/watch?v=oQqMrtc6kJQ

g. http://www.indiastudychannel.com/resources/155250-Construction-working-

h. Reciprocating-Pump.aspx

i. http://www.turboindustries.com/

j. http://nptel.ac.in/courses/101101058/

k. http://www.learnengineering.org/2013/08/Turbomachinery.html

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O 1	PS O 2
CO1	List basic properties of the fluid.	2	3	1	-	-	-	-	-	-	-	-	1
CO2	Measure the parameters such as pressure, velocity and flow rate by means of various devices.	1	3	3	-	-	-	-	-	-	-	-	3
CO3	Calculate major and minor losses in a piping system.	1	3	3		2	-	-	-	-	-	-	-
CO4	Conduct trial on hydraulic machines and draw operating performance curves.	1	3	3		2	-	-	-	-	-	-	3
CO5	Select pumps and turbines for a particular application.	1	3	3	-	-	-	-	2	-	-	-	3
CO6	Locate faults in pumps and turbines and suggest remedies	1	3	2	-	-	-	-	2	-	-	-	3

Course Curriculum Design Committee

SrNo	Name of the faculty members	Designation and Institute
1	A.W Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	A.B Deshpande	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **MACHINING PROCESSES**

COURSE CODE **6M202**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Third

1. RATIONALE

The diploma technicians are often come across various machining process in practice. It is therefore very important to known the fundamentals of various types of the chip forming processes and the tools used for the same. These will help the diploma technician to handle and improve the practical knowledge effectively. Basics of the common chip forming processes used are introduced at this course.

2. COMPETENCY

At the end of studying this course students will be able to

"Produce components using various types of machining processes."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	200
2	-	4	6	80	20	50#	50	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **;PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Interpret mechanics of metal cutting.
2. Analyze lathe machine parts and operation.
3. Summarize drilling machine operations.
4. Describe boring machine operation.
5. Evaluate working of shaping,planning,slotting & broaching machines
6. Produce jobs using various machines

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit –I Mechanics Of Metal Cutting	1a. Describe single point cutting tool with nomenclature. 1b. Describe chip formation processes. 1c. Select Chip breakers 1d. Use of cutting fluids in machining processes.	Mechanics Of Metal Cutting 1.1 Tool geometry and tool signature of single point cutting tools. 1.2 Chip formation, continuous chip, discontinuous chip, Built-up edge, 1.3 Chip breaker, cutting tool materials, cutting fluids, 1.4 Introduction to multi-edge cutting tools eg. twist drills, milling cutters.
Unit– II Metal Turning	2a. Explain constructional details and specification of lathe machines. 2b. Identify different operations to be performed on a job.. 2c. Calculate taper angle and set compound rest accordingly. 2d. Select relevant machining parameters for a given job. 2e. Compute machining time for a given jobs 2f. Describe turret head, stoppers, indexing mechanism, auto feeding.	Metal Turning 2.1 Introduction of centre lathe, classification, basic parts of centre lathe and their functions, lathe specification, lathe operations. Center lathe accessories, attachments. Cutting parameters and machining time calculations (simple numerical) 2.2 Introduction to Capstan and turret lathes and automats, tooling set-ups, different attachments and accessories, tool layout.

Unit–III Drilling Machines	3a. Explain constructional details and specification of a given drilling machines. And locate different parts 3b. Identify different operations to be performed on a job. 3c. select drill and mount in spindle. 3d. Describe the nomenclature of standard twist drill. 3e.Differentiate countersinking and counter boring. 3f. Compute machining time for a given jobs	Drilling Machines 3.1 Classification of drilling machines, principal parts, specifications, accessories, 3.2 Operations such as drilling, reaming, tapping, tapping attachment, deep drilling, step drilling, countersinking, counter boring, etc. 3.3 Cutting parameters and machining time calculations (simple numerical) 3.4 Types of drills
Unit – IV Boring	4a.Explain constructional details and specification of a boring m/c. 4b.Differentiate between drilling and boring. 4c.Explain boring heads, boring bars. 4d.Application of boring tools	Boring 4.1 Introduction to boring machines, description of boring machines, standard specifications of boring machines. 4.2 Boring bars,boring heads, boring tools.
Unit– V Shaping, Planing And Slotting	5a. Explain constructional details and specification of a shaping m/c. 5b. locate different parts of shaping m/c 5c. Describe quick return mechanism, feed mechanism 5d. Identify the basic parts of planning machine. 5e. Describe slotting machine. 5f. Identify parts of slotting machine.	Shaping, Planing And Slotting 5.1 Classification, principal parts of shaping machines, quick return mechanism, operation performed on shaper, 5.2 Horizontal shaping machines and their specifications, adjustment of stroke length and positioning of Ram. 5.3 Types of planning machines, principal parts of planning machines, operations performed on planning machines, specifications, cutting tools.

		5.4 Description of slotting machines, specification, and operations performed, cutting tools used
Unit– VI Broaching	6a.Explain constructional details and specification of a broaching m/c. 6b.Classify broaching operations 6c. Application of broaching.	Broaching 6.1 Introduction to broaching operation, types of broaching machines. 6.2 Broaching tools, applications of broaching

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Mechanics Of Metal Cutting	06	02	06	04	12
II	Metal Turning	06	04	08	06	18
III	Drilling Machines	05	04	06	04	14
IV	Boring	04	02	04	04	10
V	Shaping Planing and Slotting	08	04	08	06	18
VI	Broaching	03	02	04	02	08
		32	**18**	**36**	**26**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Regrind the single point cutting tool	04
2	II	Turning Plain Turning, Step Turning, Taper Turning, Grooving, Chamfering, Thread Cutting	20
3	III & IV	Drilling and Boring Prepare a job containing drilling and boring operation as per given drawing.	08
4	V	Shaping machine, Planning machine and Slotting Machine a) Plain Shaping b) Angular Shaping	18
5	VI	Prepare a job containing broaching operation as per given drawing (like holes of circular, square, or irregular shapes, keyways and teeth of internal gears.)	14
Total			**64**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1) Prepare journal for practicals.

2) Visit to concern industries.
3) Write specifications of different machine tools observed during industrial visits.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

Sr No.	Title of Book	Author	Publication
1	Workshop Technology Vol. II	Hajra, Choudhary	Media promoters and publishers limited (ISBN 97881850991)
2	Workshop Technology Vol.1I	P.N.Rao	Mcgraw hill (ISBN 9781259081231)
3	Production Technology Vol. II	Khanna O.P. and Lal	Dhanpat rai publications,New Delhi
4	Hand book on production Technology	HMT	Tata Mcgraw hill (ISBN 9780070964433)
5	Workshop Technology Vol.1	Raghuwanshi,	Dhanpat rai and sons

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

S. No.	Name of equipment	Brief specification
1.	Hacksaw	As per Workshop specification
2.	Lathe with standard and special accessories	As per Workshop specification
4	Milling machines-Vertical and Horizontal with standard accessories and indexing/dividing head.	As per Workshop specification
5	Column drill.	As per Workshop specification
6	Radial Drill	As per Workshop specification
7	Slotting	As per Workshop specification
8	Planning	As per Workshop specification
9	Tool and cutter grinder	As per Workshop specification
10	Automats-turret and capstan.	As per Workshop specification
11	• Required cutting tools-HSS and Carbides. • Required cutting tool holders.	As per Workshop specification

12. LEARNING WEBSITE & SOFTWARE

a. http://nptel.iitm.ac.in/video.php?subjectId=112105126
b. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/pdf/LM-01.pdf
c. http://www.youtube.com/watch?v=H0AyVUfl8/k&list=PLEFE7D1579523C45D
d. http://www.youtube.com/watch?v=FFzRIop5bpg&list=PL843C2A830C65E2EE
e. http://www.youtube.com/watch?v=81Fdif5e85c
f. http://www.youtube.com/watch?v=A0dTvf_Q8BA&list=PL2C105C94D2955C8B
g. http://www.youtube.com/watch?v=tDc0l9Gm8D4&list=PL3AFB507B668AF162
h. http://www.youtube.com/watch?v=THVgkBnjLq0
i. http://www.youtube.com/watch?v=6VpCBk7FahI
j. http://www.youtube.com/watch?v=7wC1u4WOV1o
k. http://www.youtube.com/watch?v=VDIoUZuTunI
l. http://www.youtube.com/watch?v=fGqc9mZS0YI
m. http://www.youtube.com/watch?v=Mn9jpqI8rao

n. http://www.youtube.com/watch?v=8SuoH5aL1SY
o. http://www.youtube.com/watch?v=xxNZSQML_ZA
p. http://www.youtube.com/watch?v=XXUHZxweBcw&list=PLD07DE61CB871A0CB

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Interpret mechanics of metal cutting.	3	2	2	1	-	-	-	-	-	2	2	2
2	Analyze lathe machine parts and operation.	2	2	3	2	2	1	-	-	-	2	2	3
3	Summarize drilling machine operations.	1	2	3	2	-	1	-	-	-	2	1	1
4	Describe boring machine operation.	1	2	3	2	-	-	-	-	-	1	1	2
5	Evaluate working of shaping,planning,slotting & broaching machines	2	2	3	3	1	1	-	-	-	1	2	3
6	Produce jobs using various machines	1	2	3	3	1	1	1	2	1	2	2	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	D.V.Tammewar	Workshop Superintendent, Govt. Polytechnic, Aurangabad
2	S.V.Borde	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **MECHANICAL ENGINEERING MATERIALS**

COURSE CODE **6M410**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Third

1. RATIONALE

Mechanical Engineering applications involve use of different materials with varied compositions, properties and applications. A diploma engineer should have a sound knowledge of different materials, their properties and applications. Course objective is to impart knowledge to students so that they are capable to select material as per need & requirement and study different heat treatment processes.

2. COMPETENCY

At the end of studying this course students will be able to

"Identify and select the proper materials as per BIS, British, AISI standards for the different engineering applications considering their structure-property-application relationships."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
3	-	2	5	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C**- Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify and suggest particular material for specific engineering application considering property requirements.
2. Use of microscope to observe different microstructure of given specimen.
3. Conduct heat treatments on various materials and analyze the changes in structure properties.
4. Use material specification catalogues of material standards like BIS, British, AISI.
5. Analyze alloy steels, cast iron and non ferrous materials in view of types, properties and applications

5. DETAILED COURSE CONTENTS

Unit	Major Learning outcomes	Topics and sub topics
Unit-I Structure of materials and properties	1a. Classify various types of materials 2a. Draw microstructure by observing under a microscope 3a. Correlate properties of materials with their structure	1.1 Classification of materials as amorphous and crystalline, ferrous, non-ferrous 1.2 Crystal structure of metals, Space Lattice and Types of unit cells with particular reference to iron. Concept of packing density. 1.3 Common properties of metals such as tensile strength, elasticity,Plasticity,hardness, Ductility, impact strength, magnetic permeability and hysteresis

Unit-II Equilibrium diagrams	2a Describe the meaning of various metallurgical terms. 2b Compare different solid solutions w.r.t.structure and properties. 2c Draw and analyze various equilibrium diagrams for different alloy systems.	2.1 Definitions of phase, pure metal ,alloy, their properties 2.2 Solid solutions as Substitutional,Interstitial, concept of solid stability, solidification of pure metal, alloys, 2.3 Cooling curves for pure metals and alloys, Lever rule Equilibrium diagrams for isomorphous, Eutectic solid solubility systems, peritectic systems, eutectoid systems. Calculation of phases in alloy by lever rule 2.4 Allotropy of pure iron
Unit-III Iron carbon diagram and steels, cast irons	3a Draw Iron carbon diagram. 3b Describe various reactions on iron carbon diagram. 3c Classify Iron carbon alloys on diagram as steels and cast irons based on carbon percentage . 3d Draw microstructure of steels and cast irons of various compositions at room temperature	3.1 Iron carbon equilibrium diagram, detailed study of various phases such as alpha ferrite, cementite, Delta ferrite,Pearlite,Gamma Austenite, Ledeburite, Transformed Ledeburite. Three reactions of iron carbon diagram i.e Eutectic, eutectoid and peritectic reaction , critical temperature, 3.2 Concept of steels and cast irons on diagram as hypo eutectoid, eutectoid, hypereutectiod Steels and C.I, classification of steels based on chemical composition as plain carbon steels and alloy steels, low, medium and high carbon steels, etc. (Introduction only).Classification of cast irons as white, gray,nodular,etc.(introduction.)

		3.3 Study and analysis of microstructures of hypoeutectoid, eutectoid, hypereutectoid Steels and hypoeutectic, eutectic, hypereutectic Cast Irons from Iron Carbon Diagram. 3.4 Variation in properties and structure in hypoeutectoid, eutectoid, hypereutectoid Steels and hypoeutectic, eutectic, hypereutectic Cast iron
Unit-IV Heat treatment of steels	4a Describe the procedure to conduct various heat treatments. 4b Compare various heat treatments. 4c Interprete structure – property relationships in every heat treatment and its practical relevance.	4.1. Transformations in steel on heating- conversion of pearlite to austenite, transformation of austenite to pearlite, non-equilibrium cooling, time temperature transformation (TTT), curves for eutectoid, hypoeutectoid and hypereutectoid steels, continues cooling rates and isothermal cooling. 4.2 Hardening & Tempering: Purpose of hardening temperature, conventional hardening process, martempering, structure of martensite and properties, quenching mediums, hardening defects, hardening of steels, Jommy end quench test. Purpose of tempering, low temperature, medium temperature and high temperature tempering. 4.3 . Annealing : Purpose of annealing, processes like full annealing, isothermal annealing, spherodising annealing, etc. Annealing, temperature

		Range.Applications. 4.4. Normalizing :Purpose of normalizing, normalizing processes, normalizing temperature range. Applications. 4.5. Subzero treatment: Retained austenite and its effects, purpose of Subzero treatment, applications as measuring tools.Applications. 4.6 Surface Heat Treatment Processes: Classification, Need of surface hardening of steels, variation of properties from surface to center, flame hardening, induction hardening with application, case hardening methods, carburizing, nitriding, Cyaniding.(Applications of these processes .)
Unit-V Alloy steels	5a Select the proper alloy steels for particular applications 5b Differentiate between plain carbon steels and alloy steels 5c Correlate structure – property relationships of alloy steels. 5d Use material specification catalogues of material standards like BIS, British, AISI.	5.1 Definition of alloy steels, classification of alloy steels, Difference between Plain carbon steels and alloy steels 5.2 Effect of alloying element on Iron- Carbon diagram, TTT diagram, effects of alloying elements on properties, Hardenability of steels. 5.3 Types of alloy steels as Cold work tool steels, Hot work tool steels, Oil Hardening Non Shrinking (OHNS) steels, High Carbon High Chromium (HCHC) STEELS, High Speed Steels, Spring steels, Stainless

		Steels, Hadfield Manganese Steels, Free Cutting Steels,Magnetic Steels their structure, composition applications/uses and heat treatments. 5.4 Indian standard and American standard, British specifications, of plain carbon steels and alloy steels
Unit-VI Cast irons	6a Differentiate between steels and cast irons 6b Compare different types of cast irons 6c Select suitable cast irons for particular applications. 6d Interpret specifications of cast irons.	6.1. Definition and classification of cast irons. Comparison of cast irons with steels 6.2 Types of cast irons as White cast irons, Gray Cast irons, Malleable Cast Irons, Nodular, cast irons, Alloy cast their structure, properties and practical applications/uses. Production of Malleable, Nodular cast irons. Indian standard specifications of various types of cast irons.
Unit-VII Non- ferrous metals/alloys	7a Select suitable non ferrous metals and alloys for specific applications. 7b Compare different non ferrous alloys and metals.	7.1 Common non-ferrous metals, physical properties and applications of metals like copper, Aluminum, Tin 7.2 Non ferrous alloys like Bronze, Brasses, Tungsten, Lead, Tin base lead based alloys, bearing metals, gun metals, etc. their composition, properties and practical applications/use. Specifications for non ferrous alloys

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Unit Name	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total marks
1	Structure of materials and properties	5	2	4	-	6
2	Equilibrium diagrams	5	2	3	3	8
3	Iron carbon diagram and steels, cast irons	5	2	3	3	8
4	Heat treatment of steels	13	4	12	6	22
5	Alloy steels	7	3	4	5	12
6	Cast irons	7	3	4	5	12
7	Non-ferrous metals/alloys	6	4	4	4	12
	Total	48	20	34	26	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/ programme outcomes. Following is the list of practical exercises for guidance.

Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

Sr No	Unit No	Practical Exercises	Approx Hours Required
1	1	Use and handling of Metallurgical Microscope a Analysis of principle & working of metallurgical microscope. b Study of different parts of microscope along with their function. c Setting of different magnifications on microscope by handling &note magnification value d Observation and record of at least 3 microstructures of steels and cast irons on microscope	04
2	1,2,3,4	Preparation of specimens of steels and cast irons	02
3	1	Determination of Rockwell hardness C scale of hardened and unhardened specimens of steels on Rockwell Hardness tester. Determination of Brinell Hardness number for specimens of Grey cast iron,Malleable, Nodular Cast Iron specimens on Brinell hardness Tester. (Any one)	02
4	3,4	Analysis of Iron carbon diagram and TTT diagrams from heat treatment point view for plain carbon steels and alloy steels and systematic recording.	04
5	2, 3, 4,6	Observations and systematic recording of micro structures. Pure iron 0.1% carbon steel ,0.2 %, 0.4% carbon steels, 0.8 and 1.2% carbon steels,White, gray, malleable, nodular, cast irons. Alloy steels and hardened steels.by observing prepared specimens on metallurgical microscope	02
6	2,4,6,7	Analysis and Operation of Muffle furnace a Study of principle of operation and parts of laboratory muffle furnace. b Operation of Muffle Furnace by following operation manual. Setting temperature on furnace.Noting temperatures while heating and slow cooling of furnace and determining heating rate and cooling rate for furnace by plotting graphs	02 02

		c Analysis and study of Temperature measuring Thermocouple in furnace.	02
7	4	Study of Heat treatments like Hardening, Annealing and Normalizing on 0.8 % carbon steel specimen in muffle furnace.	02
8		Study of Jominy end quench test for hardenability of steels	04
9	4,5,6,7	Selection of proper materials by use of Indian standard and American standard, British specifications tables for following components All types of Gears,Shafts,Axles,,Bearings, springs, shear blades, household utensils, pistons, crankshafts, camshafts, castings, Agricultural implements, turbine blades, Pistons , crank shafts, connecting rods,castings, etc.	04
10	2,3	Analysis of End color coding of steels	02
		Total	**32**

Notes:

a. It is compulsory to prepare a journal for exercises. It is also required to get each exercise recorded in journal, checked and duly dated signed by teacher.PA component of practical marks is dependent on continuous and timely evaluation of exercises.

b. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.

c. Mini project and presentation topic/area has to be assigned to the students in the beginning of the term by batch teacher.

d. Student activities are compulsory and are part of term work.

e. Term work content of industrial visit report should also include following.

i. Brief details of industry visited.

ii. Type, location, products, rough layout, human resource, etc of industry.

iii. Details, description and broad specifications of machineries/ processes observed.

iv. Safety norms and precautions observed.

v. Student's own observation on industrial environment, productivity concepts, quality consciousness and quality standards, cost effectiveness, culture and attitude.

vi. Any other details / observations asked by accompanying faculty.

For practical ESE part, students are to be assessed for competencies achieved. They should be assigned the necessary data and should be given any one experience to perform.

8. SUGGESTED STUDENTS ACTIVITIES

Sr No	Activities
1	Search different journals on ASME / SAE
2	Collect info of Indian standard and American standard, British specifications
3	Collect various samples of components of p.c.steels,alloy steels, cast irons, non ferrous alloys from industry
4	Identify equitant grades of steels from Indian standard and American standard, British specifications and find out their application areas.
5	Collect and study practical data sheets of various heat treatment of steels from industries
6	Identify various type steels , their specifications and applications used in the workshop of your college.
7	Prepare the flow process chart for various heat treatments
8	Collection and record on data on prices and sizes of available plain carbon steels,Alloy steels,Non ferrous alloys, cast irons available in market from dealers/ Websites
9	Visit to Heat treatment Shop
10	Visit to Steel rolling Mill using steel scrap for manufacturing of rolled products like angles,bars,channels,girders.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

Sr no	Unit no	Unit name	Strategy
1	1	Structure of materials and properties	Class room instructions ,Net survey,
2	2	Equilibrium diagrams	Class room instructions ,Net survey,Videos
3	3	Iron carbon diagram and steels, cast irons	Live explanation, movie,
4	4	Heat treatment of steels	Class room instructions, Videos,PPT,Practical demonstrations, Industrial vists
5	5	Alloy steels	Class room instructions ,Net survey, Case study, industrial visits
6	6	Cast irons	Class room instructions ,Net survey, Case study, industrial visits
7	7	Non-ferrous metals/alloys	Class room instructions ,Net survey, Case study, industrial visits

10. SUGGESTED LEARNING RESOURCE

Sr no	Title of Book	Author	Publication
1	Material Science and Metallurgy	O.P.Khanna.,	Dhanpatrai and sons
2	Material Science and Metallurgy	V.D.Kodgire	. Everest publication
3	Engineering Metallurgy Vol I& II	Higgins.	Prentice Hall
4	Physical Metallurgy	Avner	Tata Macgrawhill
5	Physical Metallurgy Vol I & II	Khangaonkar.	Pune Vidyarthi Gruha
6	Material Science	Narang.	Khanna Publication
7	Physical Metallurgy	Clarke Warne	Prentice Hall
8	Engineering Metallurgy	Ramarao & Vyas	Nit din publications Nagpur.

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr.No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Metallurgical Microscope	01
2	Rockwell Hardness tester	01
3	Brinell Hardness Tester	01
4	Belt Grinder	01
5	Polishing Machine	01
6	Speciment Mounting Press	01
7	Mounted specimen set of various steels , cast irons and non ferrous metals and alloys	01 set
8	Laboratory Muffle furnace with capacity of 0-1200 ^{0}C	01
9	Specification catalogues for Indian standard and American standard, British specifications	

12. LEARNING WEBSITE & SOFTWARE

i. https://en.wikipedia.org/wiki/ASTM_International

ii. https://www.astm.org/

iii. https://en.wikipedia.org/wiki/Heat_treating

iv. www.pg.gda.pl/~kkrzyszt/Topic%2010.pdf
v. https://www.youtube.com/watch?v=98lh5Q0M0cg
vihttps://www.youtube.com/watch?v=ulfCxDsVTWo

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
CO 1	Identify and suggest particular material for specific engineering application considering property requirements.	3	2	2	-	-	2		-	-	2	-	-
CO 2	Use of microscope to observe different microstructure of given specimen.	3	2	3	-	-	1	-	-	-	1	-	-
CO 3	Conduct heat treatments on various materials and analyze the changes in structure properties.	3	2	2	-	-	2	-	-	-	1	1	2
CO 4	Use material specification catalogues of material standards like BIS, British, AISI.	2	2	2	-	-	2	-	-	-	1	1	-
CO 5	Analyze alloy steels, cast iron and non ferrous materials in view of types, properties and applications	1	2	2	-	-	2	-	-	-	-	-	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.P Shiralkar	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	S.M Aher	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad
3	N.S.Khandagale	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ENTREPRENEURSHIP DEVELOPMENT**

COURSE CODE **6G306**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
All Programs	Third

1. RATIONALE

In the post liberalization era significant growth in industrial sector has led to creation of huge opportunities in manufacturing and service sector. In such a scenario especially in Indian contest it has led to innumerable opportunities for first generation entrepreneurs on a large scale. Therefore it is expected that engineers need to be developed for manufacturing, service sector and entrepreneurship development. This course, which represents Allied level of courses, aims at imparting entrepreneurial skills amongst engineers of all disciplines.

2. COMPETENCY

At the end of studying this course students will be able to

"Design a project proposal for an enterprise"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	50
2	-	2	4	--	--	--	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -.

1 Apply business/enterprise principals and characteristics.
2 Design information and supporting system related to start a business.
3 Estimate and record financial requirements.
4 Develop detailed project report.
5 Use various software related to business.

5. DETAILED COURSE CONTENTS

Unit	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics**
Unit –I Basic Concepts of Entrepreneur	1a. Describe Entrepreneur. 1b. Identify Risk Use Creative skills 1c. Describe Risk Situation. 1d. Generate Business Idea Methods and techniques to generate Business. 1e. Plan for Transforming Ideas In to opportunities. 1f. Carryout of SWOT Analysis.	Basic Concepts of Entrepreneur 1.1. Concept, Classification & Characteristics of Entrepreneur. Creativity and Risk taking, Concept of Creativity & Qualities of Creative person. Risk Situation, Types of risk & risk takers. 1.2 Business Idea Methods and techniques to generate business idea. 1.3 Transforming Ideas in to opportunities- transformation involves Assessment of idea & Feasibility of opportunity, 1.4 SWOT Analysis.

Unit– II Information And Support Systems	2a. Use Information data for business. 2b. Information related to support system. 2c. Lay down the Procedures and related to Information. 2d. Identify Govt. Support Systems related to EDP. 2e. Explore subsidies to entrepreneur.	2.1 Information Needed and Their Sources. Information related to project, Information related to support system, Information related to Procedures and formalities. 2.2 Support Systems: • Small Scale Business Planning, Requirements. • Govt. & Institutional Agencies, Formalities • Statutory Requirements and Agencies. Government Support and subsidies to entrepreneur.
Unit– III Market Assessment	3a Undertake Market survey. 3b Use Marketing skills and Survey. 3c Assess market for business opportunities.	Market Assessment 3.1 Marketing -Concept and Importance 3.2 Market Identification, Survey Key components. (Market Segmentation) 3.3 Market Assessment.
Unit– IV Business Finance & Accounts	4a. Determine product cost. 4b. Analyze for breakeven of business proposal. 4c. Maintain Business finance and accounts.	Business Finance & Accounts 4.1 Business Finance • Cost of Project • Sources of Finance • Assessment of working capital • Product costing • Profitability • Break Even Analysis • Financial Ratios and Significance 4.2 Business Account Accounting Principles, Methodology • Book Keeping

		• Financial Statements • Concept of Audit, • Trial Balance Balance Sheet
Unit - V Business Plan & Project Report	5a. Prepare Business proposal. 5b. Undertake project appraisal. 5c. Undertake cost benefit analysis. Cost benefits analysis.	Business Plan & Project Report 5.1 Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost 5.2 Project Report 1) Meaning and Importance 2)Components of project report/profile(Give list) 5.3 Project Appraisal 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis.
Unit – VI Enterprise Management And Modern Trends	6a. Manage resources. 6b. Prepare plan for productivity. 6c. Assure Quality. 6d. Explore Govt facilities (Industrial zones and SEZ.) 6e. Explore E-Commerce avenues for business.	Enterprise Management And Modern Trends 6.1 Enterprise Management: - 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance, Importance of Quality, Importance of testing 5) Industrial zones and SEZ. 6.2 E-Commerce, Concept and process. 6.3 Global Entrepreneur: role and opportunities.
Unit – VII Introduction of Bussiness Related	7a.Use business related software's. 7b. Survey Software's used in Mall , industries. 7c. Identify Software's	Introduction Of Bussiness Related Softwares 7.1 Software's used in Mall.

Softwares	used For accounting.	7.2 Software's used in Medical shops. 7.3 Software's used in industrial stores such as SAP, ERP. 7.4 Software's used for accounting such as FICO, FINNACLE

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic Concepts of Entrepreneur.	04	NA	NA	NA	NA
II	Information And Support Systems	05	NA	NA	NA	NA
III	Market Assessment	05	NA	NA	NA	NA
IV	Business Finance & Accounts	05	NA	NA	NA	NA
V	Business Plan & Project Report	05	NA	NA	NA	NA
VI	Enterprise Management And Modern Trends	04	NA	NA	NA	NA
VII	Introduction of business related software's	04	NA	NA	NA	NA
	Total	**32**	NA	NA	NA	NA

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

S. No.	**Unit No.**	**Practical Exercises** (Outcomes in Psychomotor Domain)	**Approx. Hrs. required**
1	I	Literature survey of Financial Banks for Industries– MSFC/IDBI/MSSIDC/CIDBI/MSME/DIC/ ROLE OF DIFFERENT COMMERCIAL BANKS etc.	04

2	II	Administration of readymade tools like questionnaires, opinionative, Interview schedule for product identification purpose (decision making process)	04
3	III	Development of "Business Ideas". Take any product and develop the business idea for it.	04
4	IV	Visit to MCED/MITCON- going through the product related library.	04
5	VI	Preparation of Preliminary / Detailed project report in the formats recommended by MCED/MITCON Prepare project report and study its feasibility.	06
6	VI	At least one case study of successful entrepreneur.	04
7	---	Assess yourself-are you an entrepreneur?	06
Total			**32**

8. SUGGESTED STUDENTS ACTIVITIES

1. Prepare journals based on assignments.
2. Carry out Literature survey of Financial Banks for Industries.
3. Analyze the specifications, costs, quality and availability for various types of engineering components and find the business opportunity for it.
4. Interact with supplier/trader and discuss about business opportunities available in market.
5. Designing software for requirements to start business or similar type of issues. .
6. preparing project report for any product to be manufactured.
7. Search online PPT's, PDF's, video's on the design and software's for business.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

1. Group discussion among students.
2. Arrange visits to industries and show various industrial jobs.
3. Motivate students to use internet and collect name, addresses, catalogues, rates, specifications of institutes and industries working in the area of business promotions.
4. Arrange expert lecture on various opportunities in business.

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Title of Book	Author	Publication
1	Entrepreneurship Development	----	NITTTR, Bhopal
2	The Seven Business Crisis& How to Beat them	V.G.Patel	S.Chand and Co. New Delhi
3	A handbook of New Entrepreneurs	P.C.Jain	,Dhanpat Rai and Sons
4	Entrepreneurship development	E.Gorden, K. Natrajan	Charotar Publication House
5	New Initiatives in Entrepreneurship Education And training	Gautam Jain, Debmuni Gupta	Tata Mc- Graw Hill
6	Entrepreneurship Theory and Practice	J.S.Saini,B.S.Rathore	Tata Mc- Graw Hill
7	Enterpreneurship Development and management	A.K.Singh	Laxmi Publications
8	The Beer mat Entrepreneur	South on D F	Pearson Education limited

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Computers for Practical's with internet facility
1. Software's used in Mall.
2. Software's used in Medical shops.
3. Software's used in industrial stores such as SAP, ERP.
4. Software's used for accounting such as FICO, FINNACLE.

12. LEARNING WEBSITE & SOFTWARE

i. http://www. product-list. php
ii. http://www.SAP.com/products/faro-software
iii. http://www.ERP.com
iv. http://www.fico.com
v. http://finnacle.com
vi. Visit www.ediindia.org.
vii. http://www.project reports.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO 1	Apply business/enterprise principals and characteristics.	3	3	-	-	-	-	2	-	3	-	-	2
CO 2	Design information and supporting system related to start a business.	3	3	-	-	-	-	3	-	3	-	-	-
CO 3	Estimate and record financial requirements.	3	3	-	-	-	-	3	-	3	-	-	2
CO 4	Develop detailed project report.	3	3	-	-	-	-	-	-	3	-	2	-
CO 5	Use various software related to business.	3	3	-	-	-	-	-	-	3	-	3	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Prof. A. W. Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE DEVELOPMENT OF LIFE SKILLS

COURSE CODE 6G303

Diploma Programme in which this course is offered	Semester in which course is offered
CE/ME/ETX/EE/AE/DDGM/CO/IT	Third

1. RATIONALE :

The generic skills are lifelong skills which need to be developed continuously. These skills are necessary for diploma engineers for their professional career.

This course aims to develop interpersonal skills, problem solving, decision making, Professionalism with etiquettes, ethics and value system.

This course also aims at developing an engineer as a team leader, effective member of the team and to become sound personality. It will develop the abilities and skills to perform at highest degree of quality as an individual.

2. COMPETENCY :

"Develop life skills to enhance personal effectiveness, professionalism and optimal use of resources."

3. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme (In Hours)			**Total Credits (L+T+P)**	**Examination Scheme**				
				Theory Marks		**Practical Marks**		**Total Marks**
L	**T**	**P**	**C**	**ESE**	**PT**	**ESE (OR)**	**PA**	
--	--	2	2	--	--	25@	25	50

Legends : **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice ; **P**- Practical; **C**- Credits; **ESE**- End Semester Examination; **PT** – Progressive Test, **PA**- Progressive Assessment, PR- Practical Examination, OR – Oral Examination, TW - Term Work, # External, @ Internal examination , ~ Online Examination.

4. COURSE OUTCOMES (COs) :

1. Develop interpersonal skills.
2. Exhibit corporate etiquettes and professionalism.
3. Enhance personal effectiveness and body language
4. Practice time management and goal setting technique
5. Develop presentation skills.
6. Manage Stress at workplaces

5 COURSE DETAILS :

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit –I Self Analysis	1a. Identify Strengths and weaknesses of an individual 1b.Identify opportunities, threats in different situations. 1c. Describe principle of Need Base Theory	Self-Analysis 1.1 Strength, weaknesses, opportunities and threats 1.2 Techniques of self-control 1.3 Understanding Need base Theory — Attitude, aptitude, assertiveness, self-esteem, Confidence 1.4 Understanding Self
Unit– II Communication Skills& Presentation Skills	2a. Identify techniques of communications. 2b. Describe Body language techniques 2c. Understand the principle Eye contact and facial expression. 2d. Develop appropriate presentation Skills. 2e. Use multimedia tools and technology for effective presentation. 2f. Conduct Group discussion and Interviews.	Communication Skills& Presentation Skills 2.1 Techniques of communication skills, 2.2 Body language, Dress like the audience, Posture, Gestures, Eye contact and facial expression. 2.3 Presentation Skill –Stage fright, Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language, Practice of speech. 2.4 Group discussion and Interview technique, Use of aids –OHP, LCD projector, white board
Unit III Interpersonal communication and Corporate and Etiquettes	3a. exhibit/apply inter personal skills in different situations. 3b. Practice manners and Etiquettes.	Interpersonal communication and Corporate and Etiquettes 3.1 Interpersonal communication. Through Self Development and change. 3.2 Polished personal habits 3.3 Ethics & Etiquettes: a way of life, what are ethics, how ethics help

		to ensure positive interpersonal relations, 3.4 Personal value system, Personal Attire & Grooming 3.5 Cell phone manners
Unit IV Time Management and goal setting.	4a. Understand importance of time management. 4b. Apply time management skills. 4c. Set the goals for career growth.	Time management and Goal Setting 4.1 Time management skills in groups for completion of project 4.2 Factors that lead to time loss and how they can be avoided 4.3 Time matrix & urgent versus, Important jobs 4.4 Importance of goal setting 4.5 How to set SMART goals.
Unit V Health and Stress Management	5a. Manage health for personal efficiency. 5b. Describe Stress Management, 5c. Use strategies to overcome stress 5d Understand emotions	Health and Stress Management 5.1 Importance of health management, 5.2 Relevance of it, 5.3 Tips to maintain good health 5.4 Strategies to overcome stress, understanding importance of good health to avoid stress. 5.5 Stresses in groups, understand and identify emotions, how to control emotions, emotional intelligence.
Unit VI Problem Solving Techniques and Creativity	6a. participate in technical Quizzes and puzzles. 6b.Use problem solving techniques 6c. Describe factors	Problem Solving Techniques and Creativity 6.1 definition of problem, types 6.2 solving Puzzles and technical quizzes. 6.3 Reducing conflict by preventing problems in the classroom.

	enhancing creativity	6.4 Creativity concept, Tips and ways to increase creativity, importance of creativity.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY) :

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Self-Analysis	4	NA	NA	NA	NA
II	Communication Skills & Presentation Skills	6	NA	NA	NA	NA
III	Interpersonal communication and Corporate and Etiquettes	6	NA	NA	NA	NA
IV	Time management and Goal Setting	6	NA	NA	NA	NA
V	Health and Stress Management	6	NA	NA	NA	NA
VI	Problem Solving Techniques and Creativity	4	NA	NA	NA	NA
	Total	32	-	-	-	-

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED EXERCISES/PRACTICALS :

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	1) Analyze self with SWOT techniques.	04
2	II	2) Present a topic (related to technical advancement should be given to a group of five to six students. Group should search the necessary information from various sources and prepare a systematic power point presentation. All such presentations should be delivered in front of class by groups. Presentations are to be evaluated by teacher).	04
3	II	3) Deliver extempore (Topic will be given to the individual for a speech of 5 to 8 minutes. Here the individual speeches of students will be conducted and evaluated by group of students.)	04
4	II	4) Participate in Group Discussion (Teacher should form group of six to eight students and give topics for group discussion. Group discussions should be carried out and evaluated by teacher)	04
5	III	5) Exhibit Etiquettes in different situations (Visit to any one place like office/firm/development sites etc. and observe the communication and etiquettes.)	04
6	IV	6) Prepare your individual time table for a week - a) List down your daily activities. b) Decide priorities to be given according to the urgency and importance of the activities. c) Find out your time wasters and mention the corrective measures. d) Set short term and long term goal for PT/TEE/Gymkhana -sport/gathering event etc.	04

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
7	V	7) Demonstrate simple Yoga postures and other stress relieving techniques by professional persons and narrate his/ her experiences.	04
8	VI	8) Participate in Quizzes, puzzle- solving and educational games and narrate his/her experiences.	04
Total			**32**

8. SUGGESTED STUDENT ACTIVITIES :

Following is the list of proposed student activities like:

- Following activities will be undertaken as per their convenience. students are advice to submit their report about participation in activities.
- 1. Case studies to be discussed in a group and presentation of the same by group /group leader.
- Carry out Field exercises and prepare reports. (e.g. interact with supplier/trader and discuss about techno commercial specifications of product)
- Role play by individual/group leader.
- Sharing of self -experiences in a group.
- Brain storming sessions in a group
- Questionnaire -filling & discussing results of the same in a group.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any) :

i. Motivate students to use internet and collect information about various generic skills

ii. Arrange expert lecture on various topics on (two/three) SWOT analysis/Time management/Etiquettes / stress management/health management.etc.

10. SUGGESTED LEARNING RESOURCES :

A) Books

Sr. No.	Title of Book	Author	Publication
1	Pearson Education Asia	Organizational Behavior	Tata McGraw Hill
2	Marshall Cooks	Adams Time management	Viva Books
3	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
4	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.
5	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
6	You can win	Mr. Shiv Khera	Macmillan ,India Ltd.
7	Wings of Fire	Mr .Abdul Kalam	Universities Press
8	Prabhavi Vyaktimatwa	SEEMA GUPTA	SAKET PUBLICATION
9	Yoga Dipika	Mr. Iyyengar	Rohan prakashan
10	Tan Tanavache Niyojan (Marathi)	Dr. Anand Nadkarni	Majestic Publishing House
11	Tandrust Raha ,Mast Jaga.(Marathi)	Dr. Rajiv Sharangpani	Continental Prakashan

B) Software/Learning Websites:

Websites related to soft skills.

11. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
CO1	Develop interpersonal skills	-	-	-	2	-	-	-	2	3	-	-	-
CO2	Exhibit corporate etiquettes and professionalism	-	2	-	-	2	-	-	2		-	-	-
CO3	Enhance personal effectiveness and body language	-	-	2	-	-	-	-	-	-	2	-	-
CO4	Practice time management and goal setting technique	2	-	2	-	-	-	-	2	2	-	-	-
CO5	Develop presentation skills	-	2	-	-	-	-	2	-	-		-	-
CO6	Manage stress at workplace	-	2	-	-	2	-	-	-	-	2	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr.Uday V. Pise	Head of Department , Mechanical Engg. Govt. Polytechnic, Aurangabad
2	Prof. R. T. Aghao	Lecturer in Applied Mechanics., Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

NON EXAM:6G311 TO 6G328

Course Structure:

Teaching Scheme		Evaluation Scheme						
TH	0		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks						
TOTAL	02	Duration						

(LIST OF NON EXAM COURSES)

6G311	Personality Development
6G312	Entrepreneurship Development(CE)
6G313	Hobby Electronics
6G314	Spoken English
6G315	German
6G316	French
6G317	Yoga
6G318	Music instrumental
6G319	Two wheeler maintenance
6G320	Entrepreneurship Development(EE)
6G321	Electrical maintenance
6G322	Electronic maintenance
6G323	Computer Hardware Maintenance
6G324	Japanese
6G325	Music vocal
6G326	aerobics
6G327	Indian classical Dance
6G328	Sewing machine maintenance

COURSE TITLE STRENGTH OF MATERIALS

COURSE CODE 6R202

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Common to branches(ME and AE)	Third

1. RATIONALE: Analysis and design of different machine components needs the basic understanding and application of mechanical properties of material and their behavior under different loading and stress conditions. Mechanical Engineer should be able to analyze behavior of materials and machine components under various types of loads. This course enables to understand different types of loads and corresponding effects on materials and machine components under various loading conditions so that appropriate material of suitable strength can be selected for the machine parts.The experiments to be conducted in laboratory will integrate knowledge and desired skills as regards to the behavior of components and materials.

2. COMPETENCY:

At the end of studying this course students will be able to,

1. Analyze structural components/machine components using different methods.
2. Investigate various structural properties of materials by conducting tests under different loading conditions.

3. TEACHING AND EXAMNATION SCHEME :

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE@ (PR/OR)	PA (TW)	150
3	-	2	5	80	20	--	50	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PR**- Practical**; C**-Credits**; ESE**- End Semester Examination**; PT – Progressive Test, PA**- Progressive Assessment, OR –Oral Examination, TW - Term Work, # External, @ Internal, ~ Online Examination.

4. COURSE OUTCOMES :

At the end of studying this course students will be able to: -

1. Analyse structural behaviour of materials under various loading conditions.
2. Select material considering engineering properties for the given structural applications/machine components.
3. Draw shear force diagram and bending moment diagram for statically determinate beams.
4. Determine the bending and shear stresses in beams.
5. Determine direct and bending stresses due to eccentric loading.
6. Design shafts for given criteria.

5. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit –I Stress and Strain	1a. Evaluate material properties under longitudinal, lateral, shear loads. 1b. Analyze composite sections under direct load. 1c. Explain concept of various types of shear with examples. 1d. Evaluate elastic constants for given criteria 1e. Identify type of load(gradual/sudden/impact and corresponding stress) 1f. Calculate temperature stress and strain for given sistuation	1.1 Definition of rigid, elastic and plastic bodies. Definition of stress, strain, elasticity, Hook's law, elastic limit, modulus of elasticity. SI units. 1.2 Standard Stress-strain curve for mild steel and HYSD bar, Yield stress/ Proof stress, Ultimate stress, breaking stress and percentage elongation, working stress. 1.3 Deformation of bars of uniform and stepped cross sections under axial load/ forces applied at intermediate sections 1.4 Composite sections under axial load, modular ratio, equivalent area. 1.5 Longitudinal and Lateral strain, Poisson's ratio, biaxial and tri-axial stresses, volumetric strain, change in volume, Bulk modulus. 1.6 Shear stress and strain, modulus of rigidity, simple and complementary shear stresses. Concept of single shear and double shear, punching shear. 1.7 Relation between modulus of elasticity, modulus of rigidity and bulk modulus(without derivation) 1.8 Concept of gradual, sudden and impact load and corresponding stress development.(No derivation of stress formulae and no numerical) 1.9 Temperature stress and strain for bodies of homogeneous material with uniform cross sections, deformation fully prevented
Unit– II Moment of Inertia	2.a Compute Moment of Inertia, polar moment of inertia, section modulus of symmetrical and unsymmetrical sections.	2.1 Definition, moment of inertia (M.I.) of plane lamina, radius of gyration, section modulus, parallel and perpendicular axes theorems (without derivation), Formulae for M.I. of rectangle, circle, semi circle, quarter circle and triangle section (without derivation). 2.2 M.I. of symmetrical and Unsymmetrical I-section, channel section, T-section, angle section & Hollow sections and built up section consisting of I section, channel sections, Angle sections with cover plates about centroidal axes and/or about any other reference axis. 2.3 Polar M.I. of solid circular sections.
Unit– III Shear force	3.a Calculate shear force and bending moment at desired points in	3.1 Statically determinate beams like Cantilever , Simply Supported & Over Hang Beam 3.2 Shear Force and Bending Moment, Relation

and bending moment diagram	statically determinate beam. 3.b Draw Shear Force & Bending Moment Diagram for astatically determinate beam,,locating point of contra shear and contra flexure.	between load, shear force and bending moment(without derivation) 3.3 Sagging & Hogging Bending Moment and theirimportance . 3.4 Point of Contra-shear, point of contra-flexure & their importance. 3.5 S.F & B.M Diagram for Cantilever, Simply Supported& over hang beam subjected point loads, uniformly distributed loads. Position of Point of contra shear, point of contra flexure.
Unit– IV Bending and Shear Stresses in beams	4.a Apply Bending Theory. 4.b Identify nature of bending stresses, Determine bending stresses and shear stresses at various locations in the beam. 4.c Plot bending stress and shear stress distribution diagram. 4.d Design section of beam from flexural strength and shear strength.	4.1 Concept of pure bending, Bending of different types of beams (elastic curves) and development of bending stresses and their nature, neutral axis. 4.2 Theory of simple bending, assumptions,, flexural formula with meaning of all terms, section modulus, bending stress distribution diagram, moment of resistance. 4.3 Shear stress equation (without derivation), Meaning of terms used in equation, Relation between maximum and average shear stresses for solid rectangular and solid circular beam sections. 4.4 Shear stress distribution for solidSquare, Rectangular and circular sections. Simple numerical problems based on shear equation.
Unit– V Direct and Bending Stresses	5.a Describe concept of eccentric load and its effect. 5.b Determine resultant stresses due to eccentric load. 5.c Plot resultant stress distribution for eccentric load	5.1 Concept of direct & eccentric load, effects of eccentric load. 5.2 Members subjected to eccentric load with eccentricity about one principle axis only, maximum and minimum stress, resultant stress distribution diagram 5.3 Condition for no tension, middle third rule, core of the section and limit of eccentricities for rectangular and circular sections
Unit– VI Torsion	6.a Describe concept of torsion. 6.b Determine stress, angle of twist due to a torque and section of shaft for given conditions. 6.c Determine power transmitted by the shaft.	6.1 Theory of pure torsion, assumptions, torsion equation with meaning of all terms(without derivation) , stress distribution diagram across the solid and hollow shaft. 6.2 Design of solid and hollow shaft.(No numerical on comparison of shafts) 6.3 Power transmitted by a shaft.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Simple Stress and strain	12	04	04	08	16
II	Moment of Inertia	06	02	02	08	12
III	Shear force and bending moment diagram	08	02	04	10	16
IV	Bending and shear stresses in beam	06	02	04	06	12
V	Direct and bending stresses	08	02	02	08	12
VI	Torsion	08	02	02	08	12
	Total	**48**	**14**	**18**	**48**	**80**

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIMENTS/ TUTORIALS :

(Any Ten practicals *Marked practical are compulsory)

Sr.No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	Demonstrate the operation of universal testing machine and compression testing machine by taking trial on sample test pieces.	02*
2	I	Perform tension test on mild steel as per IS432-1:1982	04*
3	I	Perform tension test on Tor steel as per IS1786:2008	02
4	I	Conduct Izod and Charpy Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS1757(Charpy),1598(Izod)	04*
5	IV	Conduct Flexural test on timber beam on rectangular section in both orientation as per IS2408:1963	02
6	I	Conduct compression test on three metals (with b/d ratio=1)	02
7	I	Perform Single Shear and double shear test on any two metals eg. Mild steel/ brass/aluminum/copper / cast iron etc as per IS 5242:1979	02
8	I	Perform Rockwell Hardness test on three metals as per IS1586:2000	02*

9	I	Perform Brinell Hardness test on three metals as per IS1500:2005	02
10	I	Carry out Compression test on timber section along the grain and across the grain as per IS2408:1963	02
11	VI	Perform torsion test on mild steel	02*
12	III	Drawing of Shear force and Bending Moment diagrams of cantilever, simply supported and overhanging beams for different types of loads two problems on each type of beam	06*
TOTAL			**32**

8. SUGGESTED STUDENTS ACTIVITIES:

Other than class room and laboratory activities following are the suggested co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences.

SR.NO.	ACTIVITY
1	Compare stability of different geometric shapes.
2	Survey the market and prepare list of various type of structural steel sections commonly used.
3	Collect the data of beams from field situations and correlate it with SFD and BMD numerical
4	Collect the data of various machine components subjected to tension, compression, shear, bending and combination of these.
5	Collect at least three Course question papers (MSBTE or Institute) and their model answers.
6	Draw SFD and BMD using free software.

9**. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES:**

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-

b. Q & A technique.

c. Demonstration.

d. Activity based learning.

f. Use of video, animation films to explain concepts, facts and applications of mechanics.

10. SUGGESTED LEARNING RESOURCE:

S.No.	Name of Book	Author	Publication
1	Strength of Materials	R. K. Rajput	S Chand & Co. Ltd. ISBN 978-8121925945
2	Strength of Materials	R. S. Khurmi.	S Chand & Co. Ltd. ISBN 978-8121928229
3	Strength of Materials	S. Ramamurtham.	DhanpatRai& sons ISBN 9788187433545
4	Mechanics of Structure Vol 1	S. B. Junnarkarand H. J. Shah	Charotar Publishing House Pvt. Ltd. ISBN 978-9380358659
5	Strength of Materials	Ratan S. S.	Tata McGraw Hill Education, ISBN-9385965514

11. LIST OF MAJOR EQUIPMENTS AND MATERIALSREQUIRED:

Sr.No.	Name of equipment	Brief specification
1	Universal Testing Machine	Capacity - 100 tonnes. Type: Mechanical type digital, electrically Operated. Accessories: (1) Tensile test attachment for flat and round specimen up to32 mm. (2) Compression test attachment (3) Shear test attachment with sizes of bushes 5,6,8,10,12,16,20,24 mm, (4) Transverse test attachment with bending Punch,(5)Service tools,(6) Operation and maintenance manuals - 2 nos. (7)Hardness attachment.
2	Extensometer	Least count - 0.001 mm. Max. Extension = 5 mm. Single dial gauge for 30,40 mm. 60 mm, 80 mm, 100 mm, gauge length.
3	Rockwell Hardness Testing Machine	10 kgf and major loads; are 60,100,150 kgf.; Rockwell hardness scales such as HRA, HRB, HRC, etc. is obtained by using different types of indentors (Diamond / Ball); Test height x Throat is - 215 x 132 mm; Extra test height and throat of 295 x 148 mm, Machines strictly conforms to IS:1586- 2000
4	Brinell Hardness Testing Machine	Test loads from 500 to 3000 kgf in steps of 250kgf; The height X Throat is 380 X 200 mm; Indentation measurement by Brinell Microscope of 25 X Magnification; Special Test fixtures for odd jobs / production testing can be supplied (Optional); Computerized Brinell Impression measurement system (Optional); Manual / Optical /Computerized type Brinell Hardness testing machine are also available; Accuracy conform to IS:2281-2005 and

		BS:240
5	Impact Testing Machine	CHARPY Test Apparatus: Pendulum drop angle 140°; Pendulum effective Wt 20-25 kg; Striking velocity of pendulum 5-6 m/sec; Pendulum impact energy 300 j; Min scale graduation 2 J; Distance of axis of pendulum rotation from center of specimen to specimen hit by pendulum 815 mm. IZOD Impact Test Apparatus: Pendulum drop angle: 90°-120; Pendulum effective Wt: 20-25 kg; Striking velocity of pendulum: 3-4 m/sec; Pendulum impact energy: 168 j; Min scale graduation: 2 J; Distance of axis of pendulum rotation from center of specimen to specimen hit by pendulum : 815 mm
6	Compression Testing Machine	Digital display manual control compression testing; machine; Max. Capacity (KN): 2000 ; Measuring range: 4%-100% of FS; Relative error of reading: ≤ ±1%; Max. distance between two platen (mm): 330; Compression platen size (mm): 220×220; Max. piston stroke (mm): 0-20; Max. piston speed (mm/min): Approx. 30; Column clearance (mm): 300×200; Oil pump motor power (KW): 1.5; Whole dimensions (mm): 855*380*1435
7	Torsion Testing Machine	Fixed with auto torque selector to regulate torque ranges Contains geared motor to apply torque to specimen through gearbox. Attached with autographic recorder for relation between torque and angle of twistAccuracy + 1 % of the true torqueSuitable For: Torsion and Twist test on diverse metal rods and flatsTorque Measurement by pendulum dynamometer system.

12. LEARNING WEBSITE &SOFTWARE:

i. http://nptel.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/4_1.pdf
ii. nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm
iii. en.wikipedia.org/wiki/Shear_and_moment_**diagram**
iv. www.freestudy.co.uk/mech%20prin%20h2/**stress**.pdf
v. www.engineerstudent.co.uk/**stress_and_strain**.html
vi. https://www.iit.edu/arc/workshops/pdfs/**Moment_Inertia**.pdf
vii. https://www.youtube.com/watch?v=-JG9IEqRzQ4
viii. https://www.youtube.com/watch?v=4VIhh6sGkrI
ix. https://www.youtube.com/watch?v=EcPGKLUE04I
x. https://www.youtube.com/watch?v=-ndT35aqDfAQ
xi. https://www.youtube.com/watch?v=ZJn_Mj2HeNM
xii. https://www.youtube.com/watch?v=KU1gHy8Adrc

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs) :

Sr. No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Analyse structural behaviour of materials under various loading conditions.	2	2	3	-	-	-	-	-	-	-	-	-
2	Select material considering engineering properties for the given structural applications.	3	3	-	-	-	-	-	-	-	-	-	-
3	Draw shear force diagram and bending moment diagram for statically determinate beams.	2	2	-	-	-	-	-	-	-	3	-	-
4	Determine the bending and shear stresses in beams.	3	3	2	-	-	-	-	-	-	-	-	-
5	Determine direct and bending stresses due to eccentric loading.	3	3	-	-	-	-	-	-	-	-	-	-
6	Design shafts for given criteria	1	3	2	-	-	-	-	-	-	-	-	-

Course Curriculum Design Committee:

SrNo	Name of the faculty members	Designation and Institute
1	Rajesh T. Aghao	Sr.Lecturer in Applied Mechanics, Govt. Polytechnic, Aurangabad
2	Ganesh M. Kechkar	Sr.Lecturer in Applied Mechanics, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **COMPUTER INTEGRATED MACHINING**

COURSE CODE **6M406**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fourth

1. RATIONALE

The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time. To satisfy industrial need, the use of CAD/CAM & automation is inevitable. This course emphasizes on various principles of CAD/CAM, robotics and automation. The prerequisites of this subject have been introduced in earlier subjects such as engineering graphics, engineering drawing & mechanical engineering drawing.

2. COMPETENCY

At the end of studying this course students will be able to

"Apply principles of CAD/CAM and automation and work on CNC machines"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	50
2	-	2	4	--	--	25#	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Select computer hardware and software for CAD/CAM applications
2. Conceptualize drafting and modelling in CAD.
3. Prepare a CNC part programme.
4. Operate CNC machine for manufacturing a component.
5. Make a suitable robotic configuration for a given application.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Introduction to CAD/CAM	1a. Use of computers in industrial manufacturing 1b. Identify the various elements of CAD/CAM hardware and basic structure of CAD/CAM	1.1 Role of Computers in industrial manufacturing. Product Cycle CAD/CAM, 1.2 CAD/CAM hardware and basic structure, CPU, Memory, I/O devices, Storage devices and system configuration
Unit - II Geometric Modeling	2a. Identify the need for geometric modeling 2b. Suggest different geometric models for a given application. 2c. Apply different geometric modeling methods for part modeling	2.1 Requirement of geometric modelling, Types of geometric models. 2.2 Constructive solid geometry, boundary representation, parametric modelling. 2.3 Solid modelling- Primitives & Boolean operations, Free formed surfaces (Classification of surface only) (No numerical treatment)
Unit - III Introduction to CNC	3a. Understand different types of controls. 3b. Suggest criteria for selection of parts suitable for CNC machines. 3c. Identify various control systems used in CNC operation.	3.1 Introduction - NC, CNC, DNC 3.2 Advantages, disadvantages and Application of CNC. 3.3 Classification of CNC system, depending on feedback control 3.4 Motion control system - point to point, straight line, Continuous path (Contouring).

Unit - IV Part programming	4a. Identify the different NC codes used in part programming. 4b. Apply suitable part programming method for a given component. 4c. Prepare a simple part program for a given component. 4d. Prepare advance part program using do loop, canned cycle and subroutine.	4.1 Fundamentals of part programming, 4.2 Types of part programming, Manual part programming, computer aided part programming and automatically programmed tool (APT). 4.3 NC–Words, Programming format, simple part programming 4.4 Use of canned cycles, subroutines and do loops.
Unit - V Industrial Robotics	5a. Identify various physical configurations and basic robotic motions. 5b. Identify various components of a robot. 5c. Suggest the various applications of robotics in industries.	5.1 Introduction, physical configuration, basic robot motions, 5.2 Technical features such as - work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, and robot sensors. 5.3 Application – Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.
Unit – VI Automation	6a. Identify the basic elements of automated system. 6b. Compare the various levels of automation 6c. Identify various components of FMS and suggest the applications of FMS.	6.1 Basic elements of automated system, advanced automation functions, 6.2 Various levels of automation and comparison 6.3 Flexible manufacturing system, Introduction, FMS equipment, FMS application.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Introduction to CAD/CAM	05	--	--	--	NA
2	Geometric Modeling	05	--	--	--	NA
3	Introduction to CNC	05	--	--	--	NA
4	Part programming	05	--	--	--	NA
5	Industrial Robotics	06	--	--	--	NA
6	Automation	06	--	--	--	NA
	Total	**32**	-	-	-	-

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	Compare the conventional and CAD/CAM based product cycle used in industry.	02
2	II	Applications of various methods of geometric modeling.	02
3	IV	Prepare simple part programs for any two given components.	02
4	IV	Prepare a part program using canned cycles, subroutine and do loop for given turning component.	04
5	IV	Prepare a part program using canned cycles, subroutine and do loop for given milling component.	04
6	IV	Machining of one turning component and one milling component on CNC machine.	10
7	IV	Report writing on visit to industry having CNC machine.	04
8	V	Report writing on visit to industry having robotic application.	04
		TOTAL	**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of

various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1. Carry out market survey for various CAD/CAM software's used in industry.
2. Analyze the specifications, costs, quality and limitations for various types of software's.
3. Collect the information about the manufacturers of CNC machines and the various tooling's used.
4. Survey of production systems where SPM, NC and CNC machines are used in industries.
5. Collect information about the various manufacturers of robotic machines.
6. Make a list of tools and equipments used in automation industry.
7. Search online PPT's, PDF's, videos on the use of CNC and robotics used in automation industry.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Expert lectures and seminars
e. Activity based learning
f. Industrial visits

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1.	CAD/CAM	Mikell P. Groover Emory W. Zimmers	Prentice-Hall India
2.	Computer Integrated manufacturing	A.N. Venkateshwaran, Alavudeen	PHI publication
3	Automation, Production Systems & Computer Integrated Manufacturing	Mikell P. Groover,	Pearson Education, Inc., 2001
4	CNC machines	M. Adithan, B.S. Pabla	New Age Internaional, 2008

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	CAD/CAM software such as SolidWorks or Pro-E .	Standard specification
2.	Simulators for CNC part programming and simulation purpose	Hass make or equivalent
4	CNC lathe	TL1 Hass make along with all accessories.
5	VMC	TM1 Hass make along with all accessories.

12. LEARNING WEBSITE & SOFTWARE

a http:// web.iitd.ac.in/~hegde/cad/lecture/L01_Introduction.pdf
b http:// www.engr.uvic.ca/~mech410/old/2_Lecture_Notes/5_Geometric_Modeling.pdf
c http://www.nptel.ac.in/courses/108105063/pdf/L-23(SM)%20(IA&C)%20((EE)NPTEL).pdf
d http://www.iitk.ac.in/infocell/TA201N2012/cncforwebsite.pdf
e http://www.cadem.com/downloads/CNC%20Milling%20programing%20guide.pdf
f http://eia.udg.edu/~fgarciab/docs/VIBOT/UdG_FR_C1.pdf
g http://aima.eecs.berkeley.edu/slides-pdf/chapter25.pdf
h http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf
i http://www.rockwellautomation.com/global/about-us/company-overview.page

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

S. No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Select computer hardware and software for CAD/CAM applications	2	3	2	2	1	-	-	-	-	2	2	2
2	Conceptualize drafting and modelling in CAD.	2	3	2	2	-	-	-	1	-	2	3	1
3	Prepare a CNC part programme.	1	3	3	2	-	-	-	1	2	2	2	-
4	Operate CNC machine for manufacturing a component.	2	3	2	3	1	-	-	2	-	2	3	2
5	Make a suitable robotic configuration for a given application.	2	3	3	3	1	-	-	1	-	2	1	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	V. M. Bukka	Lecturer in Automobile Engineering, Govt. Polytechnic, Aurangabad
2	A. H. Choudhari	Lecturer in Automobile Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **THERMAL ENGINEERING**

COURSE CODE **6M205**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fourth

1. RATIONALE

Thermal Engineering forms one of the core engineering subjects for Mechanical Engineering students. The course will enable students to establish foundation required to design, operate and maintain different thermal equipment.. Thermal power plants are still contributing major share in electricity production in India. Students will be able to calculate various parameters required to determine the performance of these devices and also solve the common problems associated with these devices.

2. COMPETENCY

At the end of studying this course students will be able to

"Use the principles of thermodynamics and analyze thermal engineering devices for different applications."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
3	--	2	5	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal

4. COURSE OUTCOMES

At the end of this course students will be able to: -

1. Apply laws of thermodynamics to devices based on thermodynamics.
2. Apply first law of thermodynamics for ideal gas in closed systems.
3. Solve problems by using steam table and charts.
4. Analyze broad based working of steam turbines.
5. Analyze broad based working of steam condensers.
6. Calculate rate of heat transfer by different modes of heat transfer.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of Thermodynamics	1a. Describe thermodynamic properties. 1b. Identify different types of energy in thermodynamics. 1c. Interpret various laws of thermodynamics. 1d. Apply first law of thermodynamics to given situation. 1e. Apply second law of thermodynamics to given situation.	1.1 Basic Concepts - Concept of pure substance, types of systems , properties of systems, Extensive and Intensive properties, flow and non-flow processes, specific volume, temperature, density, pressure. processes and cycles. 1.2 Energy - Work, Heat Transfer and Energy Thermodynamic definition of work and heat, difference between heat and work. energy – Potential Energy, kinetic Energy, internal Energy, Flow Work, concepts of enthalpy and physical concept of entropy. 1.3 Laws of Thermodynamics - Zeroth law, first law of thermodynamics, second law of thermodynamics, Kelvin Planks, Clausius statements and their equivalence. Reversible and irreversible processes, factors making process irreversible, reversible Carnot cycle for heat engine and refrigerator. 1.4 Application of Laws of Thermodynamics - Steady flow energy equation and its application to boilers, engine, nozzle, turbine, compressor and condenser. Application of second law of thermodynamics to heat engine, heat pump and refrigerator.

Unit– II Ideal Gases and Ideal Gas Processes	2a. Identify terms involved in characteristic gas equation. 2b. State different laws. 2c. Calculate different energy changes during ideal gas processes.	2.1 Avogadro's law, calculate molar volume. Derivation of characteristic gas equation using Boyle's and Charles's law, characteristic gas constant and universal gas constant. 2.2 Ideal gas processes – Isobaric, Isochoric, Isothermal, Isentropic, Polytrophic, Throttling and their representation on P-V and T-S diagrams. Determination of work, heat, internal energy, enthalpy change and entropy change. (only simple numerical based on above).
Unit– III Steam and steam boiler	3a. Identify process of generation of steam. 3b. Calculatevarious properties of steam. 3c. Represent different vapor processes on suitable co-ordinates. 3d. Explain construction and working of basic boilers. 3e. Demonstrate boiler mountings and accessories.	3.1 Steam fundamentals - Applications of steam, generation of steam at constant pressure with representation on various charts such as PV, T-S, H-S. Properties of steam and use of steam table, dryness fraction, degree of superheat, sensible and latent heat, boiler efficiency, Mollier chart. 3.2 Vapor processes - Constant pressure, constant volume, constant enthalpy, constant entropy process (numerical using steam table to determine dryness fraction and enthalpy), Rankine cycle. 3.3 Steam Boilers - Classification, Construction and working of - Cochran, Babcock and Wilcox, La-mont and Loeffler boiler, Boiler draught. Indian Boiler Regulation (IBR) (to be covered in practical periods). 3.4 Boiler mountings and accessories.
Unit-IV Steam Nozzles and turbines	4a. Explain concept of steam nozzle. 4b. Describe construction and working of steam turbines. 4c. Illustrate compounding in steam turbines. 4d. Explain regenerative feed heating methods with neat sketch. 4e. Explain methods of governing of steam turbines with neat sketches. 4f. Enlist losses in steam	4.1 Steam nozzle - Continuity equation, types of nozzles, concept of Mach number, critical pressure, application of steam nozzles. 4.2 Steam turbine - Classification of turbines, Construction and working of impulse and reaction turbine. 4.3 Compounding of steam turbines and its types, Regenerative feed heating, bleeding of steam, governing and its types, losses in steam turbines (no velocity diagrams and numerical).

	turbines.	
Unit –V Steam Condensers	5a. Explain construction and working of given condenser. 5b. Identify sources and effects of air leakage in given steam condenser. 5c. Explain construction and working of various types of cooling towers. 5d. Compare various types of cooling towers.	5.1 Steam condensers - Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers. 5.2 Condenser performance - Sources of air leakage and its effect, concept of condenser efficiency, vacuum efficiency (Simple numerical). 5.3 Cooling Towers - Construction and working of forced, natural and induced draught cooling tower.
Unit-VI Heat transfer and heat exchangers.	6a. Describe three modes of heat transfer. 6b. Calculate heat transfer by conduction through composite slabs and pipes. 6c. Verify Stefan Boltzmann law of radiation. 6d. Select suitable heat exchanger for given application.	6.1 Modes of heat transfer - Conduction, convection and radiation. 6.2 Conduction - Fourier's law, thermal conductivity, thermal resistance, conduction through composite walls,cylinders(Simple numerical), list of conducting and insulating materials. 6.3 Convection - Newton's law of cooling, natural and forced convection. 6.4 Radiation - Thermal Radiation, absorptivity, transmissivity, reflectivity, emissivity, black and gray bodies, Stefan-Boltzmann law. 6.5 Heat Exchangers - Classification, construction and working of shell and tube, shell and coil, pipe in pipe type and plate type heat exchanger,

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Fundamentals of thermodynamics	08	04	08	--	12
II	Ideal gases and ideal gas processes	08	04	04	08	16
III	Steam and Steam boilers	10	04	08	04	16
IV	Steam Nozzles and turbines	08	04	08	04	16
V	Steam condensers	08	04	04	02	10
VI	Heat transfer and heat exchangers	06	02	04	04	10
	Total	**48**	**22**	**36**	**22**	**80**

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. SUGGESTED EXERCISES/PRACTICALS

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain) (Any 10 practicals)**

Sr. No.	Unit No	Practical Exercises (Learning Outcomes to be achieved through practical)	Approx. Hrs. Required
1.	I	Demo of thermodynamic processes like P = C, V= C, T=C, S=C using lab model or audio visuals from website.	02
2.	I	Identification and classifications of important thermal systems like engine, compressor, refrigerator, etc. and measurement of variables like inlet and outlet Pressures and temperatures. Analysis of W& Q for each system.	02
3.	III	Observe and Draw component layout of steam power plant through animation of steam power plant from website.	02
4.	I	Determination of volume and pressure at the inlet of reciprocating air compressor.	02
5.	III	Study of Babcock Wilcox's boiler (Water tube boiler) using lab model.	04
6.	III	Study of Cochran boiler (fire tube boiler) using lab model and its comparison with water tube boiler.	02
7.	III	Study of boiler mountings and accessories using lab models and audio visuals.	02
8.	VI	Determination of thermal conductivity of a metallic rod using lab apparatus and search and analyze thermal conductivities of different materials.	02
9.	VI	Measurement of heat transfer in any one common heat exchanger in the lab (like intercooler of compressor, car radiator, etc	02
10.	V	Performance of steam condenser using actual steam generation model & condensation process	
11.	VI	Visit/Demo and report preparation of solar water heater or domestic solar electric system and prepare presentation on solar energy	02

		.Minimum 10 slides.	
12.	IV	Demo of steam turbines by using audio visuals from website.	02
13.	V	Demo of different condensers available in lab and study of its energy balance equation.	02
14.	IV	Visit to thermal power station and preparation of report.	02
15.	IV	Case study about steam power plants in Maharashtra & India w.r.t. establishment, capacity, requirements, furnaces, boilers, etc. Group PPT preparation & presentations	02
16.	III	Determination of Dryness fraction of sample steam using any one type Calorimeter	02
		Minimum number of Experiments to be completed in	**32 Hrs**

8. SUGGESTED STUDENTS ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

1 Internet survey of boilers using appropriate sources of information.
2 Prepare charts of PV & TS charts of different ideal gas processes.
3 Prepare charts of PH, HS, TS diagrams for different steam processes.
4 Draw manually enthalpy-entropy (Molliers) chart and represent different vapor processes on the same using different color combinations.
5 Sketch charts on compounding, regenerative feed heating processes.
6 Prepare a report on visit to Sugar Factory / Steam Power Plant / Dairy industry with specification of boiler and list of mountings and accessories along with their functions. List insulating and conducting materials used in various applications.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning
f. Use Internet

g. Evaluation

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Thermal Engineering	Rathore, Mahesh M.	Tata McGraw-Hill Education, New Delhi 2010, ISBN:9780070681132
2	Basic Thermodynamics	Nag, P. K.	TATA McGraw-Hill Education, New Delhi
3	Thermal Engineering	Rajput, R. K.	Firewall Media, New Delhi 2005, ISBN: 978-8170088349
4	A Textbook of Thermal Engineering	Gupta, J. K.; Khurmi R. S.	S. Chand Limited, New Delhi 1997, ISBN: 9788121925730
5	A course in Thermal Engineering	Domkundwar, S; Kothandaraman, C. P. and Domkundwar, A. V.	DhanpatRai& company, New Delhi, 2004, ISBN:9788177000214

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr. No.	Name of equipment	Brief specification
1	Two stage reciprocating air compressor with intercooler test rig. Maximum Pressure – 10 bar, with digital watt meter.	As per Mechanical Laboratory specification
2	Models of water tube and fire tube boilers (cut section models).	As per specification
3	Various mountings and accessories of boilers for assembly and dismantling purpose.	As per specification
4	Relevant simulation software.	As per specification
5	Cut section models of impulse turbine and reaction turbine.	As per specification
6	Experimental setup with convergent divergent nozzle.	As per

		specification
7	Model of surface steam condenser with assembly and dismantling purpose.	As per specification
8	Experimental setup of shell and tube steam condenser. (Minimum shell diameter 45cm).	As per specification
9	Experimental set up for determination of thermal conductivity. A Voltmeter, an ammeter and a digital temperature indicator are also provided. Specifications: Metal Rod: Mild Steel Rod, Diameter 25 mm, Length of rod 300 mm Insulation Jacket: Made in Mild Steel, Mild Steel Rod is insulated by Asbestos powder Electric Heater: Clamp Heater, Capacity 200 W, Supply 230 V AC Dimmer: Range 0-250 V AC, 2 A Digital Voltmeter: Range 0-500 V AC Digital Ammeter: Range 0-2 A AC Temperature Sensors: Type ‘K’ Thermocouples – 12 NosTemperature Indicator: 12 Channel Indicator with Selector Switch, Range 0-199.9° Frame: Made of M.S. Square Tubes & Sheets, Welded & Powder coated Optional Accessories: Rotameter for Water Flow Measurement Experimental Capabilities: Determination of thermal conductivity of Metal Rod Comparison of calculated value of thermal conductivity.	As per specification
10	Power engineering laboratory equipment.	As per specification
11	Experimental set up to verify Stefan Boltzmann law. copper hemisphere, fixed on a flat nonconducting plate. The outer surface of hemisphere is enclosed in a metal water jacket used to heat to some suitable constant temperature. Five Thermocouples are attached to the inner surface of the hemisphere. A test disc which is mounted on bakelite plate fitted	As per specification

	in a hole drilled in the center of base plate.Thermocouple is used to measure the temperature of test disc. Standard Specification to calculate the Stefan Boltzmann constant.	
12	Experimental set up to determine convective heat transfer coefficient.	As per specification

12. E-LEARNING RESOURCES

1. http://www.sfu.ca/~mbahrami/ENSC%20388/Notes/Intro%20and%20Basic%20Concepts.pdf
2. http://web.mit.edu/16.unified/www/FALL/thermodynamics/notes/node12.html
3. https://www.youtube.com/watch?v=9GMBpZZtjXM
4. https://www.youtube.com/watch?v=3dyxjBwqF-8
5. https://www.youtube.com/watch?v=02p5AKP6W0Q
6. http://www.learnengineering.org/2013/02/working-of-steam-turbine.html
7. https://www.youtube.com/watch?v=MulWTBx3szc
8. http://nptel.ac.in/courses/103106101/Module%20-%208/Lecture%20-%202.pdf
9. https://www.youtube.com/watch?v=Jv5p7o-7Pms
10. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Mechanical/Heat%20and%20Mass%20Transfer/Course_home_1.html
11. http://www.rinfra.com/energy_generation.ht

13. POS AND PSOS ASSIGNMENT AND ITS STRENGTH OF ASSIGNMENT WITH EACH CO OF THE COURSE

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
CO1	Apply laws of thermodynamics to devices based on thermodynamics.	3	3	1	1	-	1	-	-	-	2	1	1
CO2	Apply first law of thermodynamics for ideal gas in closed systems.	3	3	2	1	1	-	-	-	-	2	1	1
CO3	Solve problems by using steam table and charts.	3	3	2	2	-	-	-	1	1	3	1	-
CO4	Analyze broad based working of steam turbines.	2	3	3	2	1	1	-	-	1	2	2	-
CO 5	Analyze broad based working of steam condensers.	2	3	2	2	1	1	-	-	1	2	2	-
CO 6	Calculate rate of heat transfer by different modes of heat transfer	2	3	2	2	-	-	-	1	1	2	2	1

Course Curriculum Design Committee

Sr No	Name of the Faculty members	Designation and Institute
1	Prof. R. N. Khadse	Lecturer in Mechanical Engineering Department
2	Prof. V. B. Kumawat	Lecturer in Mechanical Engineering Department
3	Prof. P.D. Shelke	Lecturer in Mechanical Engineering Department

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **MACHINE DRAWING**
COURSE CODE **6M403**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fourth

1. RATIONALE

The course machine drawing focuses on engineering drawing principles and procedures solely applied to mechanical engineering components. This course develops ability to comprehend and apply the skills and knowledge from design and manufacturing perspective.

2. COMPETENCY STATEMENTS

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified competency expected from this course:

"To interpret and prepare working drawing of a given mechanical component."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
2	-	4	6	80	20	25#	25	
Duration of the Examination (Hrs)				04	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P**- Practical**; C**- Credits**; ESE**- End Semester Examination**; PT – Progressive Test, PA**- Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Develop lateral surface of various solids and sheet metal parts
2. Draw intersection curves of different solids.

3. Draw and use various drawing codes, conventions and symbols.
4. Interpret and draw the production drawings.
5. Interpret and prepare assembly and detailed drawings.

5. DETAILED COURSE CONTENTS:-

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit– I Development of surfaces	1a. Draw development of lateral surfaces of given solid and sheet metal parts.	1.1 Developments of Lateral surfaces of cube, prisms, cylinder, pyramids, cone. 1.2 Applications of Development of surfaces such as tray, funnel.
Unit-II Intersection of solids	2a. Apply curves of intersection to different pipe joints used in industry (like sugar, dairy and chemical plants)	Curves of intersection of the surfaces of the regular solids in the following cases: 2.1 Prism with prism(square), Cylinder with cylinder, Square Prism with Cylinder when (i) the axes are at 90° and bisecting (ii) The axes are at 90° and Offset 2.2 Cylinder with Cone: when axis of cylinder is parallel to both the reference planes and cone resting on base on HP with axis intersecting and offset from axis of cylinder.
Unit– III Conventional representation.	3a. Use IS SP-46 (1988) codes. 3b. Draw & Interpret standard conventions used in Mechanical working Drawing. 3c. Apply standard conventions in practice.	Standard conventions using IS SP – 46 (1988) 3.1 Conventional breaks in pipe, rod and shaft. 3.2 Conventional representation of common features like slotted head, radial rib, knurling, serrated shaft, splined shaft, ratchet and pinion, repeated parts, square on shafts, holes on circular pitch, internal and external thread. 3.3 Conventional representation of standard parts like Ball and roller bearing, gears, springs.

		3.4 Pipe joints and valves. 3.5 Counter sunk and Counter bored holes. 3.6 Tapers
Unit– IV Production drawings	4a. Calculate tolerances on machine components & determine the type of fit required. 4b. Interpret and apply various symbols on working drawings (like surface roughness, welding etc...)	4.1 Limits, Fits and Tolerances: Definitions, introductions to ISO system of Tolerance. a) Dimensional tolerances:- Terminology, selection and representation of dimensional tolerance- number and grade method. Definitions concerning Tolerancing and Limits system, unilateral and bilateral tolerance, Hole and shaft base systems, Types of fits- Clearance, transition and Interference, Selection of fit for engineering applications. Calculation of limit sizes and identification of type of fit from the given sizes like Ø50 H7/s6, Ø30 H7/d9 etc. 4.2 Geometrical Tolerances: Types of geometrical tolerances, terminology for deviation, representation of geometrical tolerance on drawing. 4.3 General welding symbols, length and size of weld, surface contour and finish of weld, all round and site weld, symbolic representation in Engineering practices and its interpretation. 4.4 Machining symbol and surface texture: Indication of machining symbol showing direction of lay, sampling length, roughness grades, machining allowances, manufacturing methods. Representation of surface roughness on drawing.
Unit– V Details to Assembly	5a. Apply the procedure for assembly of components. 5b. Identify various components in a given	5.1 Introduction, types of assembly drawing, accepted norms to be observed for assembly drawings, sequence for preparing assembly drawing. Bill of

	assembly and the sequence of dismantling it. 5c. Draw Assembly from given detailed drawings.	Material. 5.2 Couplings: Oldham & Universal couplings. 5.3 Bearing: Roller, Foot Step & Pedestal Bearing. 5.4 Lathe: Single(pillar type) and Square tool Post. 5.5 Bench vice & Pipe Vice. 5.6 Screw Jack. 5.7 Valve: Steam stop, Non return valve. 5.8 Piston and connecting rod of IC engine. 5.9 Lathe machine: tail stock 5.10 Drill Jig 5.11 Any other assembly consisting of 6 - 10 parts.
Unit– VI Assembly to Details	6a. Apply the procedure for dismantling and assembly. 6b. Identify various components in a given assembly and the sequence of dismantling it. 6c. Draw and Interpret details from given Assembly drawing.	6.1 Basic principles of process of dismantling the assembly into components. 6.2 Details of all assemblies mentioned in unit V.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Development of surfaces	04			08	08
II	Intersection of solids	06			16	16
III	Conventional representations	02	08			08
IV	Production drawing	04		08		08
V	Details to Assembly	08	04	04	12	20
VI	Assembly to Details	08	04	04	12	20
Total		**32**	**16**	**16**	**48**	**80**

Legends: *R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)*

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

S. No.	Practical Exercises (Learning Outcomes in to be achieved through practical's)	Unit No.	Approx. Hrs. required
1	Develop surfaces of any two solids like cylinder, cone, pyramid etc. (one Sheet)	I	04
2	Draw curves of intersection of any two objects like cylinder-cylinder, cylinder cone etc.(one Sheet)	II	08
3	Draw various Conventional Representation as per SP – 46 (1988) (one sheet)	III	06
4	Draw Dimensional and Geometrical Tolerances, welding symbols, surface roughness and Machining Symbols on given figures and tables. (one sheet)	IV	06
5	Develop Production drawing of at least two machine components showing dimensional and geometrical tolerance, surface finish etc. (One sheet)	IV	08
6	Draw assembly drawing from the given detailed drawing showing conventional representations, Dimensional and Geometrical tolerances and surface finish symbols. (One sheet)	V	12
7	Draw detailed drawings from given assembly drawing showing conventional representation, Dimensional and Geometrical tolerances and surface finish symbols. (One sheet)	VI	12
8	Redraw sheet No. 7 using Auto -Cad		08
	Total		**64**

Note

i. Given in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.
ii. To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Applying Level' of Bloom's 'Cognitive Domain Taxonomy'.
iii. For sheet No. 8, requisite knowledge about CAD commands will be given during practical hours only.

8. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes:

1. Student should maintain a separate A3 size sketch book which will be the part of term work and submit it along with drawing sheets. Following assignment should be drawn in the sketch book

a. Minimum 2 problems each on Unit No I and II.
b. Minimum 2 problems each on Unit No V to VI.
    i. Note- Problems on sheet and in the sketch book should be different.

2. Students should collect Production drawings from nearby workshops/industries and try to visualize the part from the given views.
3. Prepare paper models of development of lateral surfaces of solids
4. Visit any sheet metal workshop and prepare a report related to type of components, dimensions, material, area of application, raw material required, name of operations performed.
5. Prepare clay models of solids showing curves of intersection
6. Measurement of dimensions using Vernier for small 4-5 mechanical parts (like piston, piston rings, piston pin, connecting rod, springs, crankshaft, pulley, bearing, nuts and bolts etc…). Make a sketch and then prepare drawing showing conventional representation, Dimensional and Geometrical tolerances and surface finish symbols.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Arrange visit to nearby industries and workshops for understanding various production drawings.
b. Show video, animation films, solid modeling software to explain intersection of solid, Assembly and details
c. Prepare wall charts for Dimensional and Geometrical Tolerances.

10. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1.	Machine Drawing	N.D.Bhatt, V.M. Panchal	Charotar Publishing house pvt ltd. ISBN No:978-93-80358-63-5
2.	Engineering Drawing practice for schools and colleges IS : SP- 46	Bureau of Indian standard.	Third reprint, Octomber 1998 ISBN No: 81-7061-091-2
4.	Production Drawing	L.K.Narayanan,P.Kannaich, K.VenkatReddy	New Age International Publication ISBN No: 978-81-2243-501-6
5	Engineering Drawing	N.D. Bhatt	Charotar Publishing house pvt ltd. ISBN No:978-93-80358-17-8
6	A text book of Machine Drawing	P.S.Gill	S.K.Kataria and Sons,ISBN-13: 978-93-5014-416-9
7	Machine Drawing	Sidheshwar	Tata McGraw Hill ISBN No; 978-00-7460-337-6

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1.	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2.	Paper Models of objects for development of Lateral surfaces of solid.	1
3.	Models of solids showing intersection curves.	2
4.	Models of machine components for conventional representation	3,4,5
5.	Actual assemblies mentioned in unit V	6,7
6.	Set of various industrial drawings being used by industries. Drawing equipments and instruments for class room teaching-large size: a) T-square or drafter (Drafting Machine). b) Set squires (450 and 300-600) c) Protector. d) Drawing instrument box (containing set of compasses and dividers). e) Drawing sheets, Drawing pencils, Eraser.Drawing pins / clips	all
7.	LCD projector	All

12. SOFTWARE/LEARNING WEBSITES

a. sketch up 7 software for solid modelling
b. http://www.weldingtechnology.org
c. http://www.newagepublishers.com
d. Engineering graphics and Drawing v 1.0 from cognifront

13. POS AND PSOS ASSIGNMENT AND ITS STRENGTH OF ASSIGNMENT WITH EACH CO OF THE COURSE

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
CO1	Develop lateral surface of various solids and sheet metal parts	1	2	2	1	-	-	-	1	2	1	2	1
CO2	Draw intersection curves of different solids.	1	3	2	1	-	-	-	1	2	1	2	1
CO3	Draw and use various drawing codes, conventions and symbols.	1	3	1	1	1	-	1	1	2	2	2	-
CO4	Interpret and draw the production drawings.	2	3	3	2	1	-	1	1	2	2	2	2
CO5	Interpret and prepare assembly and detailed drawings.	2	3	3	2	1	-	-	2	2	2	2	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Vasudeo Kumawat	Lecturer in Mech. Engineering, Govt. Polytechnic,Aurangabad
2	Manik B Sanap	Lecturer in Mech. Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE MEASUREMENT AND CONTROL
COURSE CODE 6M207

PROGRAMME &SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fourth

1. RATIONALE

In practical field diploma engineer is often expected to measure or control various quantities/ parameters of various job& systems. Sound knowledge of measurement of various quantities associated with particular engineering application/ process/ equipment is very necessary. Considering vital importance of measurement and control it is essential that diploma engineer should have good proficiency of measurement and control technique.

The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force, strain and stress.

2COMPETENCIES

At the end of studying this course students will be able to

"To know various measuring instruments, control systems their working principaland applications"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
3	1	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online.

4. COURSE OUTCOMEs (COs):

1) Identify primary and secondary transducers in instrument.
2) Distinguish between various types of errors in a given instrument.

3) Interpret principle, construction& working of given measuring instrument
4) Select appropriate controller and control system for a given application
5) Calibrate the given instrument.
6) Use relevant instrument for measurement of different variables.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Measurement and measurement system	1a. Describe significance of mechanical measurement. 1b. classify instruments and state the function of instrument 1c. Compare various standards. 1d. Identify different elements of instrumentation system	1.1 Introduction, significance of mechanical measurements, methods of measurements, classification of instruments, functions of instruments and measuring systems. 1.2 Generalized measurement systems and its functional elements. 1.3 Basic standards and units. Primary, Secondary and working standards. (No derivations & Numerical)
Unit – II Instrument Characteristics	2a Describe static and dynamic characteristics of instruments. 2b Identify different errors in instruments.	2.1 Static terms & Characteristics, Range & Span, Accuracy & Precision, Reliability & Errors, Correction, Calibration. Hysteresis & Dead zone, Drift, Sensitivity, Threshold & Resolution, Repeatability & Reproducibility, Linearity. 2.4 Dynamic Terms & characteristics, Speed of Response & Measuring Lag, Fidelity & Dynamic Error, Overshoot, Dead Time & Dead zone 2.3 Measurement of Errors Introduction, Classification of Errors like Instrumental Error, Environmental Error, Translational & Signal Transmission Error, Observation Error, Operational

		Errors. (No Derivations)
Unit – III Introduction to control systems & Controllers	3a State need of control system 3b Review advantages and application of Automatic Control System 3c Explain Open Loop and Closed Loop Control System 3d Compare various types of control actions 3e Identify different elementsof servo motor and stepper motor	3.1 Need of Control System, Manual Vs. Automatic Control System, Advantages of Automatic Control System, Open Loop and Closed Loop Control System and their comparison, Concept of Feedback, Definition of Transfer Function 3.2 Basic types of control action like ON/OFF, Proportional, Integral, Derivative Type. Comparison of Pneumatic and Hydraulic Control System. 3.3 Servo motor-Construction & application in position control system, Stepper motor-Construction & applications
Unit – IV Pressure Measurement	4a List low and high Pressure Measuring instruments. 4b Select appropriate pressure measuring device.	4.1 DefinitionUnits of Pressure, Terminology of Pressure Measurement. 4.2 Low Pressure Measurement, McLeod Gauge, Thermal Conductivity Gauge, Ionization Gauge 4.3 High Pressure Measurement Manometers, Electrical Resistance Pressure Gauge (No Derivations & Numerical)
Unit – V Flow Measurement	5a Classify different types of Fluid Flow. 5b Choose a flow meter for a specific application	5.1 Definition of Flow, Different types of Flows, Classification of Fluid Flow, 5.2 Measurement Techniques Inferential & Positive Flow Meters, Cup & Vane Anemometers, Turbine Meter, Hot Wire Anemometer, Ultrasonic Flow Meter, (No Derivations & Numerical)
Unit – VI Temperature Measurement	6a State different temperature scales. 6b Use of temperature measuring devices as	6.1 Definition of Temperature, Utility of Temperature Measurement, Temperature Scales, classification of Temperature

	per temperature range. 6c Describe measurement techniques for temperature measurement.	Measuring Instruments 6.2 Liquid in Glass Thermometers, Thermocouples-Laws, Elements of Thermocouple System, Thermocouple Materials, Resistance Thermometer, Thermistors, Radiation&optical Pyrometer. (No Derivations & Numerical)
Unit – VII Force & Power Measurement	7a Describe working of Platform and Pendulum Scale, Analytical andElectromagnetic balance, 7b Explain construction and working of given dynamometers.	7.1 Concept of Force, Work, Torque & Power, Force measurement by using scales- Platform and Pendulum Scale, Balances: Analytical and Electromagnetic balance 7.2 Shaft power measurement – Mechanical brakes, Hydraulic dynamometer, Eddy Current dynamometer and Strain Gauge Transmission dynamometer. (No Derivations & Numerical)
Unit – VIII Miscellaneous Measurement	8a. Identify various techniques of liquid level measurement. 8b. Select strain gauge for a specific application 8c. Describe measurement techniques for displacement Measurement. 8d. Classify Speed Measurement devices	8.1 Liquid level measurement, sight glass, Float gauge, float and shaft, bubbler or purge system, float operated rheostat 8.2 Strain Measurement Definition of Strain & Utility of Strain Measurement. Types of Strain Gauges & Gauge Factor, Strain Measurement Techniques, Strain Gauge Materials, 8.3 Resistance Strain Gauge-Bonded & Unbounded. Linear Variable Differential Transducer & Rotary variable DifferentialTransducer. (No Derivations & Numerical) 8.4Mechanical tachometer, Electrical tachometers: Drag cup Tachometer, Inductive pickup type, photoelectric type, Stroboscope.

		(No Derivations & Numerical 8.5 Sound Measurement- Introduction,carbonmicrophone, Electromagnetic microphone

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Measurement and measurement system	4	6	2	-	8
2	Instrument Characteristics	4	2	4	2	8
3	Introduction to control systems & Controllers	8	2	6	4	12
4	Pressure Measurement	6	2	6	2	10
5	Flow Measurement	4	2	4	4	10
6	Temperature Measurement	4	2	6	2	10
7	Force & Power Measurement	6	2	4	4	10
8	Miscellaneous Measurement	12	2	6	4	12
Total		48	20	38	22	80

Legends:*R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit Number	Practical Exercises	Hrs. required
1	I	1.1 Introduction to measurement & control lab 1.2 Correlate generalized measurement system & its components with example like Bourdon Pressure gauge.	4
2	II	2.1. Identify different types of errors in given measurement system 2.2 Study of Dead weight Tester for Calibration of pressure gauge using web videos and lab model	2 2
3	III	Demo and study of ON-OFF temperature controller on furnace	2
4	IV	Measurement of Pressure by using any one Method Bourdon Pressure/ McLeod Gauge.	4
5	V	Measurement of Flow by using any one	4

		Rotameter /Anemometer	
6	VI	Measurement of Temperature by using anyone Thermocouples / Thermistors.	4
7	VIII	Force measurement on load cell demonstrator.	2
8	VIII	Measurement of Speed using any one Stroboscope/Inductive pick up/optical transducer	2
9	VIII	Study of Strain measurement by strain gauge using audio visuals from website and lab setup	2
10	VIII	Measurement of Displacement using linear Variable differential transducer.	2
11	VIII	Measurement of Sound using sound level meter	2
Total			32

Notes:

a. It is compulsory to prepare a journal for exercises. It is also required to get each exercise recorded in journal, checked and duly dated signed by teacher.PA component of practical marks is dependent on continuous and timely evaluation of exercises.

b. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.

c. Mini project and presentation topic/area has to be assigned to the students in the beginning of the term by batch teacher.

d. Student activities are compulsory and are part of term work.

e. Term work content of industrial visit report should also include following.

i. Brief details of industry visited.

ii. Type, location, products, rough layout, human resource, etc of industry.

iii. list instruments used for measurement. Report on process of calibration of instruments.

iv. Safety norms and precautions observed.

v. Student's own observation on industrial environment, productivity concepts, quality consciousness and quality standards, cost effectiveness, culture and attitude.

vi. Any other details / observations asked by accompanying faculty.

f. For practical ESE part, students are to be assessed for competencies achieved.

8. SUGGESTED LIST OF STUDENT ACTIVITIES(To be accomplished in Tutorials 1 hour per week)

Sr. No.	Activities	Hrs(16)
1	Draw skeleton sketches of different instruments on half imperial drawing sheet. Attach same with term work.	2
2	Collect practical information regarding various standards (primary,secondary,working standard)	2
3	Collect specifications of instruments from web search.	2
4	List instruments available in laboratories of department. Record scale ranges	2
5	List Industrial applications of various pressure gauges and temperature gauges	2
6	List Industrial applications of various controllers & strain gauges	2
7	Convert units such as pressure kg/sq.cm to lb/sq.inch, temperature deg C to deg. F.	2
8	Visit to testing and calibration laboratories. Observe process of calibration.	2

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCES

Sr. No	**Title of Book**	**Author and Publication**
1	Mechanical measurements and instrumentation	A.K.Sawhney Dhanpatrai and sons,New Delhi
2	Mechanical measurements and Control	R.V.Jalgaonkar Everest Publishing house Pune
3	Mechanical and Industrial measurements	R.K.Jain Khanna Publications ,New Delhi
4	Instrumentation measurements and analysis	B.C.Nakra and K.K.Chaudhari Tata McGraw Hill, New Delhi
5	Industrial instrumentation and Control	S.K.Singh Tata McGraw Hill, New Delhi
6	Mechanical Measurements	S.L.Gavhale NiraliPrakashan Pune

7	Control System Engineering	Ogatta, Prentice Hall of India Pvt. Ltd.

11. LIST OF MAJOR EQUIPMENT/ INSTRUMENT WITH BROAD SPECIFICATIONS

Sr.No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Bourdon tube pressure gauge model. Range 0-28 kg/sq.cm, Mounting position Vertical (NL90 ±5°)	1
2	Dead weight pressure gauge tester. Pressure ranges from 10-200 psi (1-15 bar) Shell spindle oil 22, viscosity 40 cs@ 20°C	1
3	Rotameter. Water (20°C): 0.002 l/h min, 10 m3/h max, max. Process pressure depending on tube 6-16 bar	2
4	Venturimeter. Pipe OD 114.3 mm, ID 97.2 mm. pipe thickness 8.56 mm, upstream and downstream angle 30 deg. Max. pressure 100 bar, operating temp.260 deg c.	2
5	Thermocouple. Material type E (chromel (+) purple, constantan (-) red, range 0-293 deg.c, limits of error +- 4%.	1
6	RTD (resistance temperature detector) Nikel- iron -80 to 260 deg c.	1
7	Load cell demonstrator Excitation voltage Operating range 10-14 VDC, Maximum Current: 3 mA @ 12VDC excitation, temp. range 0-100 deg.F standard.	1
8	Stroboscope Flash Rate Range: High Range: 60 – 120,000 FPM, 1 – 2,000Hz, Low Range 60 – 12,000 FPM, 1 – 200Hz, Accuracy 0.02 % ± 1 digit at 77˚ F	1
9	LVDT (Linear Variable Differential Transducer) Power: ±5 V dc, Ambient Temperature: -40 to 50 deg.C (-40 to 122 deg F) Input: 0 to 1.0 V ac from LVDT based belt scale, Output: 0 to 50mV dc to Accumass BW100	1

12. LEARNING WEBSITE & SOFTWARE

List of Software/Learning Websites.

a http://www.ni.com/white-paper/13034/en/

b http://encyclopedia.che.engin.umich.edu/Pages/ProcessParameters/PressureMeasurement/PressureMeasurement.html

c http://www.slideshare.net/snesajid/temp-measurement.

d https://www.sensorex.fr/meggitt/lvdt-2/

13. MAPPING OF PROGRAMME OUTCOMES (Pos) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (Cos)

SR. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
1	Identify primary and secondary transducers in instrument.	2	2	2	2	-	-	-	-	-	-	2	2
2	Distinguish between various types of errors in a given instrument.	3	3	3	2	-	-	-	-	-	-	2	3
3	Interpret principle, construction & working of given measuring instrument	3	2	3	2	-	-	-	-	-	2	2	3
4	Select appropriate controller and control system for a given application	2	2	3	2	-	-	-	1	-	1	2	2
5	Calibrate the given instrument.	3	3	2	2	-	-	-	-	-	-	2	1
6	Use relevant instrument for measurement of different variables.	3	3	3	2	-	-	-	-	-	-	2	3

Course Curriculum Design Committee

Sr No	Name of the Faculty members	Designation and Institute
1	Prof. S.M Aher	Lecturer in Mechanical Engineering Department
2	Prof. N.S.Khandagale	Lecturer in Mechanical Engineering Department

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **BASICS OF ELECTRICAL ENGINEERING AND ELECTRONICS**

COURSE CODE **6R203**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical/Automobile	Third/Fourth

1. RATIONALE

This course is intended to help the students to get clear idea of fundamentals of electrical and electronic components and develop practical skills in using various types of components employed in electrical & electronic industries. More over this course is intended to develop skills of testing electrical and electronics components as well as devices that will be really needed for the project and setting up of many experiments in other basic and applied technology courses.

2 . COMPETENCY

At the end of studying this course students will be able to

"Measure and use various electrical machines /electronic instrument by studying fundamentals"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	150
4	-	2	6	80	20	--	50	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PA**- Practical**; C**-Credits**; ESE**- End Semester Examination**; PT – Progressive Test, PA**- Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4 . COURSE OUTCOMES

At the end of studying this course students will be able to: -

1) Identify AC and DC supply
2) Apply Faraday's law, Lenz's law, Fleming's right hand rule
3) Select a motor for a given application.
4) Identify and test different electronic components.
5) Use principles of electronic circuit operations and its applications
6) Compare working of different types of power supplies

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I AC and DC Fundamentals	1a. Identify AC and DC supply. 1b. Determine the resistance of material. 1c. Derive the equation for series and parallel connection of resistance. 1d. Identify the commonly 1e. Used components used in 1f. Electrical engineering. 1g. Calculate electricity bill.	1.1 Current, emf, Electric Potential, potential difference, Resistance, Work, power, Energy. 1.2 Laws of resistance, resistivity, 1.3 Concept of AC and DC 1.4 Ohms law 1.5 Series and parallel combination of resistance 1.6 Kirchhoff's laws 1.7 Specifications of commonly used electrical appliances, calculation of electricity bill. 1.8 (Simple numerical). 1.9 Principle of generating an 1.10 Alternating voltage 1.11 Definition of Cycle, Time period, Frequency, Amplitude, Phase and Phase difference, Average value, R.M.S. value and Power Factor. 1.12 Concept of power Triangle 1.13 Advantages of three phase over single phase
Unit - II Magnetism & Electromagnetic Induction	2a. Understand the terms related to magnetism 2b. Compare electric circuit and magnetic circuit. 2c. Identify the laws applicable to different machine.	2.1 Flux, flux density, magnetic field strength, mmf, reluctance, permeability. 2.2 Comparison between electric and magnetic circuits. 2.3 Faraday's laws of electromagnetic induction, Lenz's law, Fleming's right hand rule for Generators, Fleming's left hand rule for Motors.

Unit - III Electrical machines	3a. Select suitable type of transformer for a given circuit 3b. Compare squirrel cage and slip ring induction motor. 3c. Select a motor according to application	3.1 Construction, working and classification of transformer 3.2 Significance of Emf equation (no derivation) Voltage ratio, current ratio and transformation ratio 3.3 Three phase induction motor Construction, types, principle of working and applications 3.4 Alternator: - construction and working principle and application. 3.5 Single phase Induction motors: Construction, , principle of operation and applications of – a) Split phase induction motor b) Capacitor start capacitor run induction motor 3.6 Universal motor: Construction, principle of operation and applications. 3.7 Circuit diagram of different DC motor and its application.
Unit - IV Electronic Devices	4a. Explain the working of Light Emitting Diode ,Photo diode, LDR, Photovoltaic cell, varactor diode , Point contact diode. 4b. Explain the working of Bipolar Junction Transistor (BJT), Field Effect Transistor (FET) - JFET & MOSFET, Uni-junction Transistor (UJT), power devices – DIAC, TRIAC, and SCR. 4c. Explain the working of Photo devices-, LDR, Photo diode, Photo transistor, LED & LED display (7 segment), Liquid crystal display(LCD), opto –coupler, thermistor-NTC,PTC	4.1 1Introduction to electronic devices, their symbols, principle of working and testing procedure – Diode, Zener diode, Power diode, Varactor diode, 4.2 Bipolar Junction Transistor (BJT), Field Effect Transistor(FET) - JFET & MOSFET, Uni-junction Transistor(UJT), power devices – DIAC,TRIAC, SCR, 4.3 Photo devices-, LDR, Photo diode, Photo transistor, LED & LED display (7 segment), Liquid crystal display(LCD), opto–coupler, thermistor-NTC,PTC

Unit - V Power supplies	5a. Differentiate the working of half and full wave bridge rectifier along with sketches. 5b. State and explain principle of operation of regulated and unregulated power supply. 5c. Compare Different types of UPS.	5.1 Circuit diagram and operation- Half wave, full wave & bridge rectifier. Filters – L, C, L-C, π filter 5.2 Concept of unregulated power supply, regulated power supply- line regulation & load regulation. 5.3 Principle of operation, block diagram and application of shunt regulated power supply, series regulated power supply, switch mode power supply (SMPS), 3 pin IC regulated, IC 723 adjustable power supply. 5.4 Block diagram of UPS, Concept of online and off line UPS.
Unit – VI Transistor	6a. Compare working of CB, CE and CC AMP 6b. Compare and contrast 6c. Different types of Power amplifiers. 6d. Identify oscillators and their usage in different applications.	6.1 Transistor as a switch and amplifier, single stage transistor amplifier CB, CE and CC configuration and their applications, RC coupled and direct coupled amplifier, their frequency response and application. 6.2 Power amplifier- class A, class B, class C, class AB, their comparison on operating point, conduction cycle, efficiency, application.(No circuits expected) 6.3 Oscillator – Requirement of oscillator circuit, Barkhauson's criteria of oscillator, circuit diagram and its application-. Phase shift oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillator.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	AC and DC Fundamentals	13	4	8	4	16
II	Magnetism & Electromagnetic Induction	08	2	4	2	08
III	Electrical machines	11	2	8	6	16

IV	Electronics Devices	12	4	8	4	16
V	Power supplies	09	2	4	2	08
VI	Transistors	11	2	8	6	16
	Total	64	16	40	24	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	**Unit No.**	**Practical Exercises** (Outcomes in Psychomotor Domain)	**Appx. Hrs. required**
		ELECTRICAL	
1	I	A) Observe your electrical laboratory and identify the major equipment's with their ratings. B) Prepare charts of electrical safety and understand operation of fire extinguisher. C) Use electrical tools such as pliers, screw driver, insulation cutter, tester etc.	02
2	I	Verify ohms law	02
3	I	Verify Kirchhoff's Voltage Law.	02
4	I	Verify Kirchhoff's current Law	02
5	III	Calculate transformation ratio of a given transformer.	02
6	III	Start and reverse of three phase induction motor.	04
7	III	Start and reverse of Single phase induction motor	02
		ELECTRONICS	

8	IV	Plot the V-I Characteristic of PN Junction diode.	02
9	IV	Obtain the V-I Characteristic of Zener diode	02
10	IV	Obtain the V-I Characteristic of Light emitting diode.	02
11	V	Test half wave rectifier using CRO and measure PIV of diode	02
12	V	Test full wave rectifier using CRO and measure PIV of diode	02
13	V	Test full wave bridge rectifier with C- filter using CRO	02
14	VI	Obtain input and output characteristics and calculate gain of CE amplifier circuit	02
15	VI	Obtain input and output characteristics and calculate gain of CB amplifier circuit	02
Total			**32**

8. SUGGESTED STUDENTS ACTIVITIES

1. Make a switch board using indicator, fuse, switches, plug pin socket and regulator. Then operate lamp and fan load.
2. Identify and select various measuring instruments as per required range.
3. Calculate electricity bill for student's hostel.
4. Write the specifications of appliances used at home.
5. See the videos showing working of different electrical machines and power generation
6. Prepare journals based on practical performed in laboratory.
7. Find Specifications and package of Diode, Transistor, etc. Prepare chart for characteristic of various electronics components..

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

1. Improved Lecture methods-
2. Q & A technique.
3. Demonstration
4. Seminars

5. Activity based learning.
6. Arrange visit to power station / Generating plant.
7. Motivate students to observe different types of electrical loads around them.
8. Arrange visit to Electronics industry

10. SUGGESTED LEARNING RESOURCE

S. No.	Title of Book	Author	Publication
1	Electrical Technology Vol-1	Theraja, B. L.	S. Chand & Co. Ltd., 2011 or latest edition
2	Basic Electrical Engineering	V.N.Mittle	Tata McGraw-Hill latest edition.
3	Principles of Electrical Engineering	Gupta, B.R.	S.K. Kataria,2012 or latest edition
4	Basic Electrical Engineering	Rao, Uma. K.	Pearson Education, India, 2012 or latest edition
5	Basic Electrical Engineering	Ananda Murthy, R. S.	Pearson Education, India,2011 or latest edition
6	A Course in Electrical Technology Vol. I	Gupta ,J.B.	S.K. Kataria & Sons, 2012 or latest edition
7	Electrical Technology Vol-2	Theraja, B. L.	S. Chand & Co. Ltd., 2011 or latest edition
8	Applied electronics	R S Sedha	(S Chand & Company)
9	Electronic Devices and Circuit Theory	Boylestad Robert	Pearson, 2007 or latest
10	Electronic devices and Circuits	Millman Halkias	MGH New Delhi latest edition

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

For Electrical

1. Ammeter (0-5A)
2. Voltmeter (0-150/300)
3. Millimeter
4. Rheostats (0-50/90/250/350 ohm)

For Electronics:

1. Function Generator
2. Multimeter
3. D.C. Power Supply
4. Variac
5. Cathode Ray Oscilloscope
6. Digital Storage Oscilloscope

12. LEARNING WEBSITE & SOFTWARE

i. www.allaboutcircuits.com/vol_1/chpt_ml
ii. http://openbookproject.net/electricCircml
iii. www.kpsec.freeuk.com
iv. www.howstuffwork/
v. www.nptel/electrical.com

For Electronics:

i. www.nptel.iitm.ac.in
ii. www.youtube.com. (lectures on Basic electronics)
iii. www.howstuffworks.com
iv. www.alldatasheet.com
v. Electronics Work bench

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify AC and DC supply	2	-	-	1	2	-	1	-	-	1	-	-
2	Apply Faraday's law, Lenz's law, Fleming's right hand rule	3	2	2	1	-	-	-	-	1	3	2	-
3	Select a motor for a given application.	1	1	-	-	2	-	2	-	2	3	-	-
4	Identify and test different electronic components	1	2	2	2	2	-	-	2	2	3	2	1
5	Use principles of electronic circuit operations and its applications	2	2	2	3	1	-	2	1	-	2	-	2
6	Compare working of different types of power supplies	-	1	-	-	2	-	-	-	-	1	-	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A. A. Ghate	Lecturer in Electrical Engineering, G.P. Aurangabad
2	A.D. Dabhade	Lecturer in Electronics Engineering, G.P. Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INDUSTRIAL FLUID POWER**

COURSE CODE **6M402**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical Engineering	Fourth

1. RATIONALE

Oil Hydraulic systems & pneumatic systems are widely used in all fields of engineering as clean source of motive power. Low cost automation systems with the use of pneumatics have become popular as manufacturing aids. Diploma engineers come across such systems in all segments of industries. Hence the subject will give the students basic skills and knowledge, which will be directly needed in the industrial environment.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

"Analyze and develop different components of Hydraulics and Pneumatics systems for different applications"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	125
3	--	2	5	80	20	--	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Know basic concepts of oil hydraulic systems.
2. Understand the various components of hydraulic system.
3. Develop the various hydraulic circuits for different applications
4. Know basic concepts of pneumatic systems.
5. Understand the various components of pneumatic system.
6. Develop the various pneumatic circuits for different applications
7. Develop PLC based simple Pneumatic and Hydraulic circuits

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit –I Basics of Hydraulics and pneumatics	1a. Relate physical characteristics and functions of hydraulic oils for specific conditions. 1b. Select relevant fluid for given hydraulic and Pneumatic Systems. 1c. Use hydraulic and pneumatic system components symbols for making circuits.	1.1 Applications of fluid power, General layout of oil hydraulic& pneumatic system. 1.2 Merits and limitations of oil hydraulic, comparison of hydraulic & pneumatic system. 1.3 Types of Hydraulic fluids, Properties of fluids, Selection of fluids and effect of temperature & Pressure. 1.4 Air treatment, Humidity, Drying, Condensations of compressed air, Pressure drop in Pneumatic lines. 1.5 ISO Symbols used in hydraulic & pneumatic system.

Unit– II Hydraulic system components	2a. Illustrate the construction and working of various valves, positive displacement pumps. 2b. Select relevant components for hydraulic systems. 2c. Identify material and functions of accessories used in hydraulic system. 2d. Demonstrate various components and accessories used in a given hydraulic circuits.	2.1 Pumps: Classification, Construction, working principle and applications of Vane pump, gear pump, gerotor pump, screw pump, piston Pump. Factors Selection of Positive displacement Pumps. 2.2 Pressure control Valves :- Construction, principle of working of pressure relief valve - direct, pilot operated, pressure reducing, pressure unloading, Sequence valves, counter balancing valve. 2.3 Direction control valves: - Poppet valve, spool valve, 2/2, 3/2, 4/2, methods of actuation. Types of different center positions. Check valves, pilot operated check valves. 2.4 Flow control valves:- pressure compensated, non pressure compensated flow control valve, 2.5 Actuators:-Classification, Construction, working of rotary Actuators - Hydraulic motors, Linear Actuators - Cylinders - single acting, double acting. 2.6 Accessories: - Types, Material and functions of Pipes, filters, Hoses, Fittings, Seals and gaskets, Accumulators.
Unit- III Pneumatic System components	3a. Identify material, components and accessories used in a given Pneumatic system. 3b. Select air compressor for a given application. 3c. Select relevant components for pneumatic system.	3.1 Compressor – Reciprocating & Rotary compressors. 3.2 Valves – 3.3 Pressure Control Valves Flow Control valves, Direction Control Valves. 3.4 Actuators – 3.5 Rotary - Air motors, Types, construction, working principle 3.6 Linear- Cylinders- Types, construction & working principle 3.7 Accessories – Pipes, Hoses, Fittings (Types, construction, working principle and symbols of all components), FRL

		unit
Unit– IV Basic Hydraulic Circuits	4a. Interpret a given circuit. 4b. Construct hydraulic circuit for a given applications. 4c. Diagnose faults in a given hydraulic circuit. 4d. Troubleshoot a given hydraulic system.	4.1 Speed control circuits- Meter in, Meter out, Bleed off, 4.2 Unloading, synchronizing, regenerative, counterbalance, dual pump unloading circuits. 4.3 Hydraulic circuit for milling machine and shaping machine. 4.4 Causes and Troubleshooting procedures of various hydraulic circuit components.
Unit– V Basic Pneumatic Circuits	5a. Interpret a given circuit. 5b. Construct pneumatic circuit for a given applications. 5c. Diagnose faults in a given pneumatic circuit. 5d. Troubleshoot a given pneumatic system.	5.1 Speed control circuits for double acting cylinder and bidirectional air motor. Sequencing circuits. 5.2 Stroke control circuit, intermediate stopping of piston, dual control circuit. 5.3 Time delay circuit and use of vacuum handling. 5.4 Causes and Troubleshooting procedures of various pneumatic circuit components.
Unit - VI Fundamentals of PLC	6a. Illustrate the working of PLC 6b. Identify the various components of PLC 6c. Developing ladder diagram for hydraulic and pneumatic circuits.	6.1 Introduction to PLC, advantages, disadvantages, applications 6.2 PLC architecture, various components, functions, PLC scan cycle 6.3 Input and output devices, input and output module, timers and counters. 6.4 Basics of Ladder programming, Developing Ladder diagram for simple hydraulic and pneumatic circuits

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Basics of Hydraulics and Pneumatics	04	04	04	--	08
II	Hydraulic Systems Components	10	06	08	--	14
III	Pneumatic Systems Components	08	06	06	--	12
IV	Basic Hydraulic circuits	10	04	08	06	18
V	Basic Pneumatic circuits	08	04	04	06	14
VI	Fundamentals of PLC	08	04	04	06	14
		48	**28**	**34**	**18**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	II	Assemble and dismantle any one hydraulic pump and filter.	04
2	II	Assemble and dismantle any one pressure control valve and flow Control valve	02
3	II	Assemble and dismantle any one directional control valve and actuators	02
4	IV	Develop a meter in and meter out hydraulic circuit for a given application	04
5	IV	Develop a Sequencing circuit and regenerative circuit.	04
6	III	Assemble and dismantle any one type of air motor	04
7	V	Develop a speed control circuit for a pneumatic motor.	02
8	IV	Troubleshoot faults in Hydraulics circuit/components and suggest suitable remedial measures for it.	02
9	V	Troubleshoot faults in Pneumatic circuit/components and suggest	02

		suitable remedial measures for it.	
10	VI	Develop a ladder diagram for a simple hydraulic and pneumatic circuit	06
		TOTAL	32

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1. Prepare journals based on practical's performed in laboratory.
2. Make a list of manufacturers of various components of hydraulic and pneumatic systems through internet search.
3. Visit any two industries using hydraulic and pneumatic systems and prepare a report.
4. List any five companies manufacturing PLC.
5. Visit the sites where PLC is used and make a report and write their industrial application.
6. Search online PPT's, PDF's, and videos on the various hydraulic and pneumatic applications.
7. Collect samples of different types of oils and filters along with the specifications.
8. Prepare charts for different hydraulic and pneumatic components.
9. Collect the information about the applications of fluid power systems from internet.
10. Visit and Study the construction and working of any one earth moving equipment.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Arrange visits to industries hydraulic press components and Low cost automation.
b. Motivate students to use internet and collect names of manufacturing companies of oils and filters.
c. Arrange expert lecture on various topics of PLC, low cost automation.
d. Activity based learning.
e. Q & A technique.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Oil Hydraulic system-Principles and maintenance	Majumdar S. R.	Tata McGraw Hill
2	Pneumatics Systems-Principles and maintenance	Majumdar S. R.	Tata McGraw Hill Publications,
3	Hydraulic And Pneumatic Power For Production Industrial Hydraulics	Harry L. Stewart	Industrial Press INC.
4	Industrial Hydraulic	**Pippenger, John H. Hicks,**	Tata McGraw Hill Publications, New Delhi
5	Hydraulics and pneumatics	**Andrew Parr**	Jaico Publishing House
6	Pneumatics and hydraulics	**Harry L Stewart**	D. B. Tarapoorwala and sons

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	**1. Hydraulic Trainer kit** 1. Hydraulic Power Pack. 2. Gear Pump: Discharge : 3. Hydraulic cylinder. Single Acting : 1 No. Double Acting : 1 No. 4. Valves:- Pressure Relief Valve : 1 No.,	10 LPM, 40 Kg/cm^2, 1 HP motor coupled to Gear pump 10 LPM. Pressure : upto 40 Kg/cm2 Bore 40 mm Stroke : 100 mm

	Directional Control Valve : 1 No., Non Return Valve: 1 No., Sequencing Valve : 1 No., Pressure Reducing Valve : 1 No., Flow Control Valve : 1 No., Solenoid Valve : 1 No. 5. Manifold : Multicoated block for drain connections. 6. Hydraulic Motor: Balanced Vane : 1 No. 7. Pressure Gauges : 2 Nos. 8. Filter : 1 No. , 9. Oil Reservoir, Hydraulic Hoses provided with quick change couplings : 5 No. 10. All the valves & components are mounted on the panel made from M.S. sheet. The whole unit mounted on M.S. frame for which castors are provided.	25 Microns 45 Ltr Capacity
2.	**2. Pneumatic Trainer Kit** 1. Air compressor- 01 No. 2. Filter Regulator and Lubricator (FRL) unit with Pressure gauge (10bar) – 1 No. 3. Direction control valves of different configuration (3/2 way, 5/2 way, 2/2 way & 5/3 way) and different actuations (manual / solenoid operated) of sufficient quantity to execute the experiments. 4. Set of Pressure control Valves, One way valves, Flow control valves, shut off valves, OR gate & AND gate shuttle Valves, etc.	Displacement 3cfm, Working pressure – 7kg/cm2 (7 bar) with 0.5HP 650RPM electric motor 230V, 50Hz, 1 phase with 0-10 bar pressure gauge & shut off valve with suitable hose and end connector. The port size of the valves shall be of ¼" BSP. The port size of the valves shall be of ¼" BSP. Bore 25mm, Stroke 100mm with suitable mounting arrangement - Bore 25mm, Stroke 100mm with

	5. Single acting cylinder -– minimum 1No. 6. Double acting cylinder minimum 1 No 7. Required length and quantity of pneumatic hoses with suitable end fittings of quick snap type and Ell, Straight & Tee fittings of required quantity to be provided. 50% extra spares of this hoses and fittings to be supplied. 8. Hand Tools required for carrying out the experiment – 2 sets to be supplied. 9. Required electrical controls with sockets for solenoids, etc.	suitable mounting arrangement -
3	**PLC Trainer Kit:** 1. PLC-Make:- SIEMENS LOGO / ALLEN BRADLEY MICRO 810 / STD. EQUIVALENT 2. Ladder Programming Software Logosoft / CCW (Connected Components Workbench) 3. Power Supply- 4. 2080-USB ADAPTER- 5. 2080-LCD- 1.5 LCD Display and Keypad, for Micro810 Only (Optional) 6. PLC panel dimensions- 7. Necessary Input / Output simulating devices. 8. Electrical control panel for simulation of digital inputs (consisting of Toggle Switches 8 no.& proximity sensor 1 No.) 9. Output compatibility to Solenoid valves, Electric motors as actuating elements in	Digital inputs- 8, Digital outputs- 4, PC interface facility, PC-PLC interfacing cable., Front panel for display of digital input /output status: Lamps (8 No.s), LED Indicators (4 No.s), Ladder diagram programming on PC. For Micro 810/ Standard Equivalent. 24VDC, 3A Power source. 4”X2”X2” USB Adapter Plug for Micro810 12-pt only 2 Ft. X 1Ft. X 2Ft. With visible transparent front fascia.

	respective assorted Modules. 10. SCADA SOFTWARE connectivity for PLC (Optional). 11. High speed Frequency input (Optional). 12 Water level tank (Optional) with Miniature Level Switches (2 No.s) and solenoid drain valve (1 No.) (Optional)	

12. LEARNING WEBSITE & SOFTWARE

a http://hydraulicspneumatics.com/fluid-power-basics/circuits
b http://hydraulicspneumatics.com/other-technologies/chapter-5-pneumatic-and-hydraulic-systems
c http://www.nitc.ac.in/dept/me/jagadeesha/mev303/Chapter2_Hydraulics_control_in_machine_tools.pdf
d http://nptel.ac.in/courses/112102011/4
e https://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/amt_airframe_handbook/media/ama_Ch12.pdf
f http://constructionmanuals.tpub.com/14273/css/Chapter-3-Hydraulic-and-Pneumatic-Systems-95.htm
g http://www.eaton.com/ecm/groups/public/@pub/@eaton/@hyd/documents/content/ct_233701.pdf
h http://www.machinerylubrication.com/Read/531/hydraulic-root-causes
i http://hydraulicspneumatics.com/blog/think-first-then-troubleshoot-chapter-8-system-tests-piston-pumps
j http://www.plantengineering.com/single-article/12-steps-to-troubleshooting-pneumatic-systems/fd1e7c3a4c54c64ac4e07a066be0ed1b.html
k http://gpmhydraulic.com/basic-pneumatic-troubleshooting/
l http://www.festo-didactic.com/us-en/training-and-consulting/catalog-of-training-courses/technology/pneumatics/pn121-maintenance-and-troubleshooting-of-pneumatic-systems.htm?fbid=dXMuZW4uNTc5LjE3LjI2LjI2NzM3LjM2NTM
m http://nptel.ac.in/courses/112103174/pdf/mod6.pdf

(Guidelines for searching the material from internet)

1. Prepare journals based on practical's performed in laboratory.
2. Make a list of manufacturers of various components of hydraulic and pneumatic systems through internet search.

3. Visit any two industries using hydraulic and pneumatic systems and prepare a report.
4. List any five companies manufacturing PLC.
5. Visit the sites where PLC is used and make a report and write their industrial application.
6. Search online PPT's, PDF's, video's on the various hydraulic and pneumatic applications.
7. Develop pneumatic and Hydraulic circuits using Automation Studio & Festo
8. Collect samples of different types of oils and filters along with the specifications.
9. Prepare charts for different hydraulic and pneumatic components.
10. Collect the information about the applications of fluid power systems from internet.
11. Visit and Study the construction and working of any one earth moving equipment

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Know basic concepts of oil hydraulic systems	1	2	-	-	-	-	-	1	-	-	-	2
2	Understand the various components of hydraulic system.	1	2	2	-	-	-	-	1	-	-	-	2
3	Develop the various hydraulic circuits for different applications	1	2	3	3	-	1	-	2	2	-	-	2
4	Know basic concepts of pneumatic systems	1	2	-	-	-	-	-	1	0	-	-	2
5	Understand the various components of pneumatic system	1	2	2	-	-	-	-	1	0	-	-	2
6	Develop the various pneumatic circuits for different applications	1	2	3	3	-	1	-	2	2	-	-	2
7.	Develop PLC based simple Pneumatic and Hydraulic circuits	1	2	3	3	-	2	-	3	2	2	-	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr.U.V.Pise	Head of the Mechanical Engineering Department, Govt. Polytechnic, Aurangabad
2	S.B.Kulkarni	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
3	A. W,Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **COMPUTER AIDED DRAFTING**

COURSE CODE **6M208**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fourth

1. RATIONALE

The market driven economy demands frequent changes in product design to suit the customer's needs. With the introduction of computers the task of modeling any complex part and incorporating frequent changes as per customer requirement are becoming simpler. Moreover, the technology driven competitive environment in today's market is compelling design/consulting engineering firms and manufacturing companies to seek CAD conversion of their existing paper based engineering documents. The focus of this course is to provide the student with hands-on experience in drafting and editing of an industrial production drawing and making them competent in latest solid modeling and assembly practices.

2. COMPETENCY

At the end of studying this course students will be able to

"Prepare digital drawings and 3D models using Computer aided drafting and Modeling software".

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	50
1	-	2	3	--	--	25@	25	
Duration of the Examination (Hrs)				--	--	02	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Use the CAD workspace and interface.
2. Draw 2D drawing entities using computer aided drawing software.
3. Develop solid models from 2D entities using Part workbench tools of parametric solid modeling software.
4. Assemble various parts using Assembly workbench tools of parametric solid modeling software.
5. Generate various orthographic views of parts and assemblies using Drafting-detailing workbench of parametric solid modeling software.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of CAD Drawing Setup	1a. Explain use of computer in drafting and designing. 1b. Use the CAD workspace and interface. 1c. Work with the User Coordinate System and World Coordinate System. 1d. Apply different object selection methods in a given situation. 1e. Open, save and close new and given drawings/ templates.	1.1 Fundamentals of Computer Aided Drafting (CAD) and its applications, Various Software for Computer Aided Drafting. 1.2 Co-ordinate System- Cartesian and Polar Absolute, Relative mode, UCS, WCS. 1.3 CAD initial setting commands- Snap, grid, Ortho, Osnap, Limits, Units, Ltscale, Object tracking etc; 1.4 Object Selection methods- picking, window, crossing, fence, last and previous. 1.5 Opening, saving and closing a new and existing drawing/template.
Unit– II Draw and Modify Commands	2a. Use viewing commands. 2b. Apply formatting commands. 2c. Draw simple 2D entities using given draw commands. 2d. Create given complex 2D entity using modify commands. 2e. Use grip command to manipulate given 2D entity.	2.1 Zoom Commands – all, previous, out, in, extent, Realtime, dynamic, window, pan. 2.2 Formatting commands - linetype, lineweight, color. 2.3 Draw Command - Line, arc, circle, rectangle, polygon, ellipse, spline, block, hatch. 2.4 Modify Command - Erase, trim, extend, copy, move, mirror, offset, fillet, chamfer, array, rotate, scale, lengthen, stretch, break, divide,

		explode, align. 2.5 Grips editing- Move, Copy, Stretch.
Unit– III Dimensioning, Text and Plot Commands	3a. Dimension given 2D entities using different dimensioning styles 3b. Apply Geometric and dimension tolerance symbols on the given entity. 3c. Write text on given 2D entity. 3d. Plot given 2D entities using proper plotting parameters.	3.1 Dimensioning commands - Dimension styles, Dimensional Tolerances and geometrical Tolerances, Modify dimension style. 3.2 Text commands - dtext, mtext command. 3.3 Plotting a drawing - paper space, model space, creating table, plot commands.
Unit– IV Working in 2D environment	4a. Use draw commands in sketcher mode. 4b. Apply dimensioning constraints to given sketch. 4c. Apply geometrical constraints to given sketch.	4.1 Introduction, Applications, Different Software packages used for Solid Modeling. 4.2 Working in Sketcher mode – Line, Profile, Circle, Arc, curves, Rectangle and their sub options. 4.3Constraints - Dimensioning constraint, Geometrical constraint.
Unit- V Part Modeling	5a. Create 3D simple model using Extrude and Revolve commands. 5b. Create 3D complex model using Extrude, Revolve Sweep, Pattern, Draft and Blend commands. 5c.Use 3D modify commands.	5.1 Working in 3D environment - Creating 3D Solid Models of simple machine parts. 5.2 3D Commands – Extrude, Revolve, Sweep, Pattern, Draft, loft and Blend. or similar commands. 5.3 Intersection of solids – Intersect two solid components by inserting new body option.
Unit– VI Assembly, Drafting & Plotting	6a. Prepare assembly of given parts. 6b. Create exploded view of the assembly. 6c. Generate 2D drawings of part models and assembly. 6d. Plot the drawing.	6.1 Assembly Drawing – Introduction to Top down and Bottom up approach of assembly. Preparation of Assembly drawing by using assembly features. (Assembly of minimum 4-5 components) 6.2 Exploded view – Explode the assembly. 6.3 Working in Drafting Mode Generate orthographic projections. This will include all types of views – front view, top view, side view, sectional views, isometric views, auxiliary views. 6.4 Dimensioning Commands – Apply

		dimensions, dimensional and geometrical tolerances. 6.5 Bill of material – Prepare part list table and name plate. 6.6 Page set up, Plot command.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER (INTERNAL) DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of CAD Drawing Setup	02	-	01	01	02
II	Draw and Modify Commands	03	-	01	02	03
III	Dimensioning, Text and Plot Commands	03	-	02	02	04
IV	Working in 2D environment	02	-	02	03	05
V	Part Modeling	03	-	02	03	05
VI	Assembly, Drafting & Plotting	03	-	02	04	06
Total		16	-	10	15	25

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1.	Customize main window and interface of the Computer Aided Drafting software using customization tool bar.	I	02
2.	Prepare a template of your institute.	I, II	02
3.	Draw 2D entities (any two) individually and modify them using	I, II	02

	draw and edit commands.		
4.	Draw different views of object like Hexagonal nut and Bolt (similar objects can be taken up) using Computer Aided Drafting software.	II, III	02
5.	Draw different views of object like flange coupling, universal coupling (similar objects can be taken up) using Computer Aided Drafting software.	II, III	04
6.	Make blocks of Hexagonal nut and bolt, Ball bearing and insert them in same or other files (similar objects can be taken up).	II, III	04
7.	Customize main window and interface of the 3D modeling software using customization tool bar.	IV	02
8.	Draw 2D simple sketch using various draw commands. (Any two) and Apply geometrical and dimensional constraints to the sketch	IV	02
9.	Draw 2D complex sketch using various draw, edit, modify and dimension commands. (Any two)	IV	02
10.	Create simple part models using commands like Extrude, Revolve,Mirror, Chamfer, Fillet, Rib, Pattern etc;	V	02
11.	Develop simple part models of Cotter joint or flange coupling.	V	02
12.	Create a simple part using commands like Sweep, Blend, Draft and loft or similar commands.	V	02
13.	Generate orthographic views of prepared solid model Assembly. Prepare Bill of materials.	VI	04
	Total		**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Maintain a separate folder on Computer workstation allotted, in which all above mentioned practical should be saved and will be submitted/ mailed as a part of term work.

b. Collect at least one 2D/3D drawing like Production drawings, Layouts from nearby workshops/industries and develop them using computer aided drafting approach.
c. Students will explain at least one problem for drafting to all batch colleagues. Teacher will assign the problem to the students.
d. Assess at least one 2D/3D drawing of other students (A group of 5-6 students may be identified by teacher) and note down the mistakes committed by the group. Selected students will also guide other students for correcting mistakes, if any.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. With respect to item No.08, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
c. Guide student(s) in undertaking micro-projects.
d. No. of practical's selection to be performed should cover all units.

10. SUGGESTED LEARNING RESOURCE

Sr. No.	Title of Book	Author	Publication
1.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Bureau of Indian Standards	BIS, GOI, Third Reprint, October 1998, ISBN: 81-7061-091-2
2.	Engineering Drawing	Bhatt, N.D.	Charotar Publishing House, Anand, Gujarat, 2010, ISBN:978-93-80358-17-8
3.	Machine Drawing	Bhatt, N.D.; Panchal, V. M.	Charotar Publishing House, Anand, Gujarat, 2010, ISBN:978-93-80358-11-6
4.	Engineering Graphics with AutoCAD	Kulkarni D. M.; Rastogi A. P.; Sarkar A. K.	PHI Learning, New Delhi (2010), ISBN: 978-8120337831

5.	Essentials of Engineering Drawing and Graphics using AutoCAD	Jeyapoovan T.	Vikas Publishing House Pvt. Ltd, Noida, 2011, ISBN: 978-8125953005
6.	AutoCAD User Guide	Autodesk	Autodesk Press, USA, 2015
7.	AutoCAD 2016 for Engineers and Designers	Tickoo Sham.	Dreamtech Press; Galgotia Publication New Delhi, Twenty Second edition, 2015, ISBN-13: 978-9351199113

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr. No.	Equipment/Instruments/Other resources name with Broad Specifications	Exp. No.
1	Networked Licensed latest version of any Parametric Computer Aided Drafting and Designing software.	All
2	CAD workstation with latest configurations (i3-i5 preferable), RAM minimum 4 GB onwards, for each student.	All
3	Operating system: Windows XP/Windows 7/ Windows 8/Windows 10 onwards.	All
4	Plotter/Printer with latest versions. (A3 and A4)	All
5	LCD projector and Screen/ Interactive board.	All

12. LEARNING WEBSITE & SOFTWARE

a. http://www.mycadsite.com/tutorials/
b. http://tutorial45.com/learn-autocad-basics-in-21-days/
c. https://www.lynda.com/AutoCAD-training-tutorials/160-0.html
d. http://www.investintech.com/resources/blog/archives/5947-free-online-autocad-tutorials-courses.html
e. http://www.cad-training-course.com/
f. http://www.solidworks.in/sw/products/3d-cad/3d-solid-modeling.htm
g. http://web.iitd.ac.in/~hegde/cad/lecture/L30_solidmod_basics.pdf
h. https://en.wikipedia.org/wiki/Solid_modeling
i. http://npkauto.com/solid-modeling/
j. https://www.youtube.com/watch?v=vjX4PDJcFOI
k. https://www.youtube.com/watch?v=5BDHS4FN2-
l. https://www.youtube.com/watch?v=JjKs-lePlPY

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

COs	Programme Outcomes											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
1. Use the CAD workspace and interface.	-	3	3	3	1	-	1	3	2	2	-	3
2. Draw 2D drawing entities using computer aided drawing software.	-	3	3	2	-	-	-	3	2	2	-	2
3. Develop solid models from 2D entities using Part workbench tools of parametric solid modeling software.	-	3	3	2	-	-	-	3	2	2	-	2
4. Assemble various parts using Assembly workbench tools of parametric solid modeling software.	1	3	3	3	2	1	1	3	2	3	3	3
5. Generate various orthographic views of parts and assemblies using Drafting-detailing workbench of parametric solid modeling software.	1	3	3	3	2	1	1	3	2	3	3	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.V.Borde	Lecturer in Mechanical Engg,Govt.Poly.Aurangabad
2	N.S.Khandagale	Lecturer in Mechanical Engg,Govt.Poly.Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **HEAT POWER ENGINEERING**

COURSE CODE **6M404**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

I.C. Engines finds applications in almost all sectors of industry and in automobiles. Diploma technicians deal with working, testing and maintenance of I.C. Engines. Use of air compressors is increasing due to automation. There is large scope for energy saving in air compressors. Hence it is necessary to understand constructional features and thermodynamic aspect of air compressor. Gas turbine is used for power generation and for jet propulsion. Diploma engineer should understand the fundamentals of refrigeration and air- conditioning as there are many industrial applications and also many entrepreneual opportunities in this field.

2. COMPETENCY

At the end of studying this course students will be able to

"To describe construction & principle working of I.C Engine, Air Compressor, Gas turbine, Refrigeration system & application in various fields"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
3	-	2	5	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Understand power cycle & represent on P-V & T-S diagram.
2. Describe construction and working of I. C. Engines.
3. Understand working of gas turbines and its application.
4. Explain different types of air compressors and conduct trial on air Compressor.
5. Describe construction, working and application of vapor compression cycle.
6. Appreciate psychometric processes and air conditioning systems.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics (Containing POs and PSOs assignment in each Sub-topic)
Unit - I. I.C. Engines and air standard cycles	1a. Draw and represent power cycles on P-V and T-S diagram 1b. Calculate cycle efficiencies. 1c. Classify I. C. Engines. 1d. Explain construction and working of two strokes & four Stroke engine.	1.1 Theoretical Power cycles - Carnot, Otto, Diesel, Dual, Brayton cycle. Representation on P-V, T-S diagram. Simple numerical on Otto and diesel cycle only. 1.2 Classification of I.C. Engines 1.3 Two stroke and four stroke engines construction, working, comparison and valve timing diagram. 1.4 Scavenging
Unit - II Air Compressor	2a. Classify air compressors 2b. Define compressor terminology. 2c. Write uses of compressed air. 2d. Explain construction and working of single & two stage reciprocating compressor. 2e. Calculate various efficiencies related with compressor. 2f. Write the advantages of multistage. 2g. Explain construction and working of different	2.1 Introduction - Classification of air compressor - Definitions Compression ratio, free air delivered, compressor capacity, swept volume. -Uses of compressed air. 2.2 Reciprocating air compressor -Construction and working of single stage and two stage compressor - Efficiency-volumetric, isothermal and mechanical without clearance volume -Two-stage compressions, perfect and imperfect inter cooling (simple numerical) - Advantages of multi staging

	rotary compressor. 2h. State Comparison and application of rotary & reciprocating compressor. 2i. Explain methods of energy saving in air compressor.	2.3 - Rotary compressor -Construction and working of screw, lobe, vane, centrifugal compressor. (No numerical) -Comparison and applications of reciprocating & rotary compressors -Purification of air to remove oil, moisture and dust 2.4- Methods of energy saving in air compressor.
Unit -III Gas Turbine And Jet Propulsion	3a. Give classification & application of gas turbine. 3b. Draw & Explain closed and open gas turbine. 3c. Write methods to improve thermal efficiency of gas turbine. 3d. Draw & Explain turbo jet, turbo prop, Ram jet and pulse jet. 3e. Explain working of rocket propulsion.	3.1 Classification and applications of gas turbine. 3.2 Constant volume and constant pressure gas turbine. -Closed and open cycle gas turbines and their comparison 3.3 Methods to improve thermal efficiency of gas turbine -Regeneration, inter cooling, reheating using T – S diagram 3.4 Jet propulsion - Principles of Turbo jet , Turboprop & Ram jet engines 3.5 Rocket propulsion Solid propellants and liquid propellants, component of liquid propellants, rocket engines.
Unit -IV Refrigeration & Air Conditioning	4a. Write principles of refrigeration. 4b. Draw & Explain vapour compression refrigeration cycle. 4c. Represent VCC on P-H &T-S diagram 4d. Write & Explain applications of refrigeration's i.e. water cooler, ice plant, cold storage... 4e. Define properties of air. 4f. Define & Explain Dalton's law of partial pressure. 4g. Show Psychometric processes on chart. 4h. Classify & Explain air	4.1 Introduction Principles of Refrigeration, COP of heat pump and Refrigerator, Tones of Refrigeration, Air Refrigeration system working on Bell-Coleman cycle. 4.2 Vapour compression system Vapour compression Refrigeration cycle, its components, representation on P- H and T-S diagram (simple numerical) - Effect of superheating and sub cooling Applications- Water cooler, domestic refrigerator, Ice Plant and cold storage. 4.3 Psychrometry Properties of air, Dalton's law of

	conditioning systems.	partial pressure, Psychometric chart and processes (No numerical) 4.4 Air conditioning systems Definition and classification of air conditioning systems.
Unit -V POWER PLANT	5a. Write the factors affecting site selection of power plant. 5b. Draw & Explain general layout of different power plant 5c. Draw & Explain MHD power generation.	5.1 Site selection 5.2 General layout of thermal, hydraulic, diesel , gas turbine and solar power plant 5.3 MHD power generation 5.4 Fuel cells.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	I.C. Engines and air standard cycles	8	02	06	06	14
II	Air compressor	12	04	08	08	20
III	Gas turbine and jet propulsion	10	04	08	06	18
IV	Refrigeration & air conditioning	12	04	08	06	18
V	Power plant	6	02	04	04	10
	Total	**48**	**16**	**34**	**30**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Demonstration/observations of cam shaft operated suction and exhaust valve functioning to study valve timing diagram of single/ multi cylinder engine.	04
2	II	Conduct trial on two stage reciprocating air compressor to determine its volumetric efficiency and isothermal efficiency.	04
3	III	Literature survey on website – • http://library.think.quest.org • http://www.grc.nasa.goe • To prepare a brief report on gas turbine and jet propulsion.	04
4	I	Conducting market survey for two wheeler and four wheeler and refrigerator/ air conditioner to collect data of specification, models, price, etc.	06
5	I	Conduct trial on refrigeration test rig for calculation of COP.	02
6	IV	Observation of working unit of split/ window air conditioner to study components layout, location and function.	02
7	V	Dismantling and assembly of hermetically sealed compressor.	04
8	V	Observations of roof mounted solar power plant w.r.t its component layout, function and net metering (including electrical accessories)	06
		TOTAL	**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Collect the technical information, leaflets, Brochures on various products given by teacher. (Here products like Engines used for two & four wheeler, Air compressor, Refrigerator, Power plant equipments, Ice plant, Cold Storage etc…)
b. Solve numerical problems.
c. Analyze the specifications, costs, quality and availability for various types of products.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a) Motivate students to use internet and collect name, addresses, catalogues, rates, specifications of manufacturers of different machines like I.C Engine, gas Turbine, refrigerator and air conditioning systems.
b) Use conventional black board method, models, cut sections, for teaching learning process.
c) Arrange visit to industry like automobile, refrigeration, S.T. Work shop, power plants etc…
d) Arrange expert lecture on power generation, jet propulsion.

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Title of Book	Author	Publication
1	Internal Combustion Engineering	Mathur and Sharma	DhanpatRai& sons
2	A Textbook of Thermal Engineering	R.S. Khurmi	S. Chand and Company
3	Heat Engines – Vol. I,II,III	Patel	Acharya Publication

		Karamchandani	
4	Thermal Engineering	P.C. Ballany,	Khanna Publisher
5	Refrigeration and Air Conditioning	Domkundwar ,Arora.,	DhanpatRai and Sons

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

Sr.No.	Name of the Equipment	Specification
1	Four stroke four cylinder Petrol engine	As per specification
2	Four stroke four cylinder Diesel engine	As per specification
3	Air compressor	As per specification
4	Refrigeration test rig	As per specification
5	Window air conditioner	As per specification
6	Hermitically sealed compressor	As per specification

12. LEARNING WEBSITE & SOFTWARE

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2
CO1	Understand power cycle & represent on P-V & T-S diagram.	1	-	2	-	-	-	-	-	1	1	1	-
CO2	Describe construction and working of I. C. Engines.	1	2	1	2	2	2	-	-	1	2	2	1
CO3	Understand working of gas turbines and its application.	1	2	2		2	2	1	1	-	2	-	-
CO4	Explain different types of air compressors and conduct trial on	2	2	3	3	-	2	-	-	2	2	2	-

	air Compressor.												
CO5	Describe construction, working and application of vapor compression cycle.	1	2	2	2	2	2	2	1	2	2	2	3
CO6	Appreciate psychometric processes and air conditioning systems.	-	2	3	2	2	-	-	-	-	-	2	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	G.G Ghuge	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	V.B Kumavat	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **DESIGN OF MACHINE ELEMENTS**

COURSE CODE **6M504**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

The course Design of Machine Elements makes the student to understand the process of load, forces, stress, strains and related parameters required to design engineering components. The design procedure and applications in engineering. The course introduces simple design of machine elements like joints, couplings, levers, springs, etc. The student will be supposed to maintain and sometimes modify the existing designs of machine parts and components as per the need. Fundamental knowledge of engineering mechanics, strength of materials, engineering materials, theory of machines and CAD is essential. Subject aims at developing analytical abilities to give solutions of engineering design problems.

2. COMPETENCY

At the end of studying this course students will be able to

" To select, assemble and design simple machine elements/parts for various applications and draw CAD drawing."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				4	1	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PR**- Practical**; C**-Credits**; ESE**- End Semester Examination**; PT – Progressive Test, PA**- Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Calculate different dimensions of machine components on the basis of various modes of failure.
2. Use a standard designing procedure for different components used in engineering practices.
3. Select proper material for jobs in industrial design.
4. Use Design Data Book and Manufacturing catalogue.
5. Prepare part and assembly drawings on CAD software

5.DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Fundamentals of mechanics.	1a. Describe Design process. 1b. Explanation of stress, strain. 1c. Describe different engineering materials and its properties. 1d. Describe limiting stresses and factor of safety	1.1 Definition of load, Stress, Strain, Design Considerations. 1.2 Significance of Stress – Strain diagram for various materials. 1.3 Study of mechanical properties of materials. 1.4 Types of failure, fatigue, endurance limit, Types of induced stresses. 1.5 Working stress and Factor of safety.
Unit - II Design Considerations	2a. Describe stress concentration. 2b. Describe Theories of failure. 2c. Describe the principle stresses Selection of materials and manufacturing processes. 2d. Use Commercial designations for engineering materials. 2e. Use Design Data Hand Book	2.1 1Stress concentration, meaning, causes and remedies. 2.2 Principal Stresses. Theories of failure, Maximum principal stress theory and Maximum shear stress theory. 2.3 Selection of proper materials and manufacturing processes. 2.4 Commercial designations of materials and Specifications, 2.5 Use of Design Data Book.

5.

Unit - III Force Considerations	3a. Describe principle in Designing of machine parts subjected to direct load. 3b. Describe Design of various joints used in engineering. 3c. Use the concept of bending, torque in design of levers and different joints for identification of areas of failure.	3.1 Design of machine parts subjected to direct load such as 3.2 Knuckle joint, socket and spigot cotter joint (Single); turn buckle etc. 3.3 Design of machine parts subjected to bending such as levers, bell crank lever, lever loaded safety valve, bearing cap. 3.4 Design of machine parts subjected to direct and bending stress such as C – clamp, Hacksaw frames, and offset links and wall brackets.
Unit - IV Shaft, Keys and Couplings	4a. Describe Design of shaft 4b. Describe the important various parameters of Design of keys. 4c. Describe & Design of different couplings and applications.	4.1 Design of shaft on the basis of rigidity and stiffness. 4.2 Design of shaft subjected to combined bending and twisting and empirical treatment 4.3 Types of keys, Design of keys Assembly using different keys. 4.4 Design of couplings such as Muff coupling, Flange coupling, and flexible coupling
Unit - V Design of screwed and welded joints	5a. Describe Stresses in screwed fasteners. 5b. Describe Design of bolts 5c. Explain types of welded joints. 5d. Describe Design of Welded joints	5.1 Stresses in screwed fasteners due to static and external forces. 5.2 Design of bolts for cylinder cover and bolts of Plummer block. 5.3 Bolts of uniform strength. 5.4 Design of eccentrically loaded bolts. 5.5 Types of welded joints, Basic weld symbols. 5.6 Design of transverse fillet weld, parallel fillet weld
Unit – VI Power screws and Spring Design	6a. Explain Concepts of screw threads used in power screws . 6b. Describe Stresses in power screws.. 6c. Explain Design of screw jack 6d. Understand the concept and	6.1 Types of screw threads used in power screws. 6.2 Force analysis on power screws. 6.3 Torque required lowering the load by squire threads. 6.4 Stresses in power screws. 6.5 Design of screw jack. 6.6 Self-locking screws and overhauling

	its application of Self-locking screws and overhauling of screw jack. 6e. Describe Types of springs 6f. Describe Design of springs.	of screw jack. Efficiency of self-locking screws. SPRING DESIGN 6.7 Types of springs and their applications. 6.8 Design of helical spring
Unit – VII Introduction To Bearings And Ergonomics & Aesthetic Consideration In Design	7a.Describe Types of bearings, bearing selection and mounting 7b. Explain Commercially available bearings in the market 7c. Describe Bearing materials and their application. 7d. Describe Ergonomics of Design. 7e. Describe Aesthetic considerations regarding shape, size, color & surface finish	INTRODUCTION TO BEARINGS 7.1Types of bearings, bearing selection and mounting. 7.2 Commercially available bearings in the market. 7.3 Bearing materials and their application. ERGONOMICS & AESTHETIC CONSIDERATION IN DESIGN 7.4 Ergonomics of Design – Man – Machine relationship. 7.5 Design of Equipment for control, environment & safety. 7.6 Aesthetic considerations regarding shape, size, color & surface finish.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Fundamentals Of Mechanics.	06	02	02	-	04
2	Design Considerations	08	00	04	04	08
3	Force Considerations	10	02	05	06	13
4	Shaft, Keys And Couplings	10	02	07	05	14
5	Design Of Screwed And Welded Joints	10	02	06	05	13
6	Power Screws And Spring Design	12	04	08	06	18
7	Introduction To Bearings And Ergonomics & Aesthetic Consideration In Design	08	02	04	04	10
	Total	**64**	**14**	**36**	**30**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	1. Assignment on selection of materials for given applications [at least five applications should be covered] using design data book. List the mechanical properties of material selected. 2. Draw drawing sheet on Properties of commonly used Cross-sections in engineering design.(Section, area, MI, Section Modulus, etc)	04 04
2	II	Design any one joint (i.e. Cotter joint, Knuckle joint) used in actual practice and Its drawing.	06
3	III	Assignment Problems on design of simple machine parts like Bell Crank Lever, Lever safety valve (One example on each component) with free hand sketches	04
4	IV	Draw drawing sheet on problem of flange Coupling design.	04
5	VI	Design Problem- Observe the System where transmission of power takes place through power Screws.(e.g. Lead screw of lathe, feed screws of machine tools, Clamping screws, Toggle Jack screw, etc.) Get the required information regarding effort, clamping force, etc., and selecting suitable materials design screw, nut and different simple components in assembly. Prepare design report and assembly drawing Indicating overall dimensions, tolerances and surface finish. Also prepare bill of materials. (Activity should be completed in a group of five to six students)	04
6	VI	Assignments on design of Helical Springs, Screwed joints, Welded joints [one each] with free hand sketches..	02
7	---	CAD drawing of any one of the above three drawings (2,4,5)should be prepared in practical and print out should be attached along with respective drawing sheets	04
Total			32

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1. Prepare journals based on assignments.
2. Carry out market survey for various materials available for study
3. Survey report should be prepared with the relevant catalogue.
4. Analyze the specifications, costs, quality and availability for various types of components designed in this subject and use of that component in equipments.
5. Interact with supplier/trader and discuss about commercial sizes of components like shafts, keys, bolts, fasteners, springs, bearings available in market.
6. Designing software for data acquisition regarding commercial sizes. .
7. Survey of Prime movers – Electric motors / I.C. Engines available in the market along with specifications suitable for your design project. Survey report should be prepared with the relevant catalogue.
8. Search online PPT's, PDF's, video's on the design

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

S. No.	Title of Book	Author	Publication
1	Machine Design	R.S.Khurmi	S.Chand and Co. New Delhi
2	Machine Design	P.V.Mandke	S.Chand and Co. New Delhi
3	Machine Design	R.K.Jain	Khanna Publication
4	Elements of Machine Design	Pandya and Shah. Charotar Publication House	Charotar Publication House
5	Introduction to Machine Design	V.B.Bhandari	Tata Mc- Graw Hill
6	PSG Coimbtore	Design Data Book	PSG Coimbtore
7	06 Abdulla Shariff	Hand Book of Properties of	Dhanpat Rai & Sons

		Engineering Materials & Design	
8	Hall, Holowenko, Laughlin	Theory and Problems of Machine	Design Mc- Graw Hill
9	Fundamentals of Machine Design Vol-01 and Vol-02	Ajeet Singh	Cambridge University press, India

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

General Readings **. IS/ International Codes** a) IS 4218: 1967 ISO Metric Threads b) IS 2693: 1964 Cast Iron Flexible Couplings c) IS 2292: 1963 Taper keys & Keyways d) IS 2293: 1963 Gib Head Keys & Keyways e) IS 2389: 1963 Bolts, Screws, Nuts & Lock Nuts f) IS 4694: 1968 Square threads g) IS 808: 1967 Structural Steel h) SKF Catalogue for Bearings
1. Different types of joints (knuckle, Gib and Cotter etc)
2. Different Shafts, couplings, keys.
3. Different fasteners with charts.
4. Different tread samples, screw jack
5. Different springs along with charts.
6. Charts showing different Bearings and Aesthetic design considerations.

12. LEARNING WEBSITE & SOFTWARE

a http://www.productdesign.com/product-list.php

b http://www.products/faro-software/cam2-measure-10/overview

c http://www.compodesign_QuickGuide.pdf

d http://www.engineering .design.com

e http:// www.slideshare.net/QRCE/product-design-development-1-presentation

f https://en.wikipedia.org/wiki/Machine_Design

g www.machinedesign.com/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Calculate different dimensions of machine components on the basis of various modes of failure.	1	2	2	-	1	-	-	-	-	-	3	-
2	Use a standard designing procedure for different components used in engineering practices.	2	3	1	2	1	-	2	1	-	2	3	-
3	Select proper material for jobs in industrial design.	1	1	-	-	-	-	2	-	-	3	-	-
4	Use Design Data Book and Manufacturing catalogue.	2	2	3	2	-	-	-	-	-	3	-	-
5	Prepare part and assembly drawings on CAD software	2	3	2	2	-	-	-	2	2	2	3	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr.U.V.Pise	Head of the Department, Govt. Polytechnic, Aurangabad
2	A.W.Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
3	S.V.Borde	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **TOOL ENGINEERING**

COURSE CODE **6M409**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

Tools are as basic component for any machining process. The quality and efficiency of any machining operation basically depends upon quality of tools which in turn depends upon the proper shape, size and material of the tools. Productivity and quality of machining operations may further be enhanced by proper and quick mounting of tools and jobs on machines. Jigs and fixture plays an important role in this process. Therefore this course attempts to develop abilities in students to select a tool of proper size and shape for required machining operation. The design of cutting tools, jigs and fixtures are also dealt with in this course.

2. COMPETENCY

At the end of studying this course students will be able to

"Develop the ability to select and/or design cutting tools, tool holders, dies, jigs and fixture for given simple component."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
3	-	2	5	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

1. Analyze metal cutting theory
2. Select proper tool for given manufacturing operation
3. Interpret designation system of cutting tool and tool holder.
4. Select locating and clamping devices for given component.
5. Select and design jig and fixture for given simple component.
6. Classify and explain various press tools and press tools operations.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Metal cutting theory	1a. Compare orthogonal cutting with oblique cutting. 1b. Sketch the geometry of single point cutting tool. 1c. Define – shear plane, cutting ratio, shear angle, rake angle, flank, rake face. 1d. Explain Mohr's circle with various forces acting on it. 1e. Describe different types of tool wear. 1f. Calculate tool life for the given set of conditions. 1g. Define machinability. 1a. Enlist the factors affecting machinability.	1.1 Orthogonal & oblique cutting, geometry & tool signature of single point cutting tool, mechanism of metal cutting. 1.2 Forces in metal cutting, Merchants circle for metal cutting 1.3 Types of chips & their significance 1.4 Tool wear & its types, factors affecting tool wear, use of cutting fluid, requirements of cutting fluid. Tool life equation 1.5 Machinability & its parameters
Unit - II Cutting tool materials	2a. Describe essential characteristics of a good tool material. 2b. Explain the properties and applications of Diamond, ceramics, CBN & Carbon tool steels. 2c. Describe the specification of cutting tool material.	2.1 Types, characteristics, properties & applications of cutting tool materials 2.2 Specifications of cutting tool materials

Unit - III Drills	3a. Explain nomenclature of drilling tool. 3b. Describe various types of drills. 3c. Explain the significance of various angles on performance of drill.	3.1 Geometry (features) of twist drill, types of twist drill 3.2 Effect of rake angle, helix angle, point angle, relief angle on performance of drill bit.
Unit - IV Milling cutters	4a. Explain the nomenclature of milling cutters. 4b. Explain various types of milling cutters. 4c. Describe the forces & torque acting on milling cutter. 4d. Describe the design procedure for milling cutter.	4.1 Milling cutter geometry 4.2 Types of milling cutter 4.3 Forces & torque acting on milling cutter 4.4 Design procedure for milling cutter
Unit - V Broaches	5a. Sketch the geometry of a broach. 5b.Describe various types of broaches.	5.1 Sketch the geometry of a broach. 5.2Describe various types of broaches.
Unit – VI Gear cutting tools	6a. Describe gear generating tools. 6b.Explain the nomenclature of hob.	6. 1 Gear teeth generating tools 6.2 Hob nomenclature.
Unit – VII Jigs & Fixtures	7a. Define Jig & fixture. 7b. Describe various types of jigs & fixtures. 7c.Explain the principles of location & clamping. 7d. Design a drill jig. 7e. Design fixtures for turning & milling.	7.1 Introduction of Jigs & Fixtures, Types of jigs & fixture. 7.2 Principles & types of locating & clamping devices. 7.3 Design of drill jigs, fixtures for turning & milling. 7.4 applications of open, swinging leaf, indexing box jig.,Turing,millimg, boring, fixtures.
Unit – VIII Press Tools	8a. Describe the mechanism of shearing. 8b. Calculate punch force & locate the centre of punch. 8c.Explain standard die set. 8d. Explain compound & progressive dies. 8e. Describe functions of pilots,	8.1 Mechanism of shearing, blanking & piercing, clearances on punch & die, punching force & center of punch. 8.2 Standard die set & its advantages, commercial & precision die set, simple, compound & progressive die

	strippers, pressure pads, stops & stock guides. 8f. Draw stock strip layout. 8g. Explain various die operations. 8h. Calculate material utilization factor.	8.3 Pilots, strippers, pressure pads, stops (manual & automatic) stock guide & stock strip layouts. 8.4 Die operations- blanking, piercing, lancing, drawing, bending, forming. Calculation of material utilization factor.
Unit – IX Bending, Drawing & Forging dies.	9a.Describe various methods of bending. 9b.Explain bending die. 9c.Define bends allowance, spring back & spanking. 9d.Explain drawing operation. 9e.Explain drawing dies. 9f.Enlist the factors affecting material flow during drawing. 9g. Calculate the blank size for drawing. 9h. Explain forging mechanism.	9.1 Methods of bending, bending dies, bend allowances, spring-back, spanking, bending pressure, bending pads. 9.2 Drawing operation, drawing die, metal flow & variables affecting metal flow during drawing, calculation of blank size for drawing. 9.3 Introduction to forging mechanism & terminology.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Metal Cutting Theory	07	06	08	02	16
II	Cutting Tool Material	02	02	02	02	06
III	Drills	03	00	02	02	04
IV	Milling Cutter	03	02	02	00	04
V	Broaches	02	02	02	00	04
VI	Gear Cutting Tools	02	00	02	02	04
VII	Jigs & Fixtures	05	00	04	04	08
VIII	Press Tools	08	02	12	06	20
IX	Bending, Drawing & Forging Dies	16	00	08	06	14
	Total	**48**	**14**	**42**	**24**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Two assignments on calculation of cutting forces & shear angle based on Merchant circle. & One assignment on designation of carbide tools & references of manufacturing catalogue.	04
2	III to VI	Sketches of different cutting tools showing details of tool features (geometry)	03
3	VIII	Sketches of progressive die, combination die, and compound die, inverted die, drawing die, bending die.(Sheet no1 & 2 each contain sketches of three dies each) use A-4 size	04
4	VIII	Drawing of stock strip layout for simple component (different component for each student on sheet no.3) use A-4 size.	02
5	IX	Assignment on description & Sketch of forging die.	02
6	VIII	Assignment on types of punches, punch holders, punches shedders, pilots & strippers.	02
7	VIII	Design of blanking die – design calculations & drawing sheets showing assembly & details (sheet no.4)	03
8	VII	Design of any one fixture (drilling/milling) for any practical component – drawing sheets showing assembly & details	04
9	II	Demonstration of ISO nomenclature for tool holders and inserts (use various manufacturer's tool catalogues)	04
10	I	Collection of various chip samples and analyze it.	04
Total			**32**

8. SUGGESTED STUDENTS ACTIVITIES

a. Download the catalogues for cutting tools, jigs and fixtures

b. Visit nearby manufacturing unit and prepare the report for same.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

Sr. No.	Unit	Unit Name	Strategies
1	I	Introduction.	Movie, Industrial visit.
2	II	Cutting tools and tool holders.	Demonstration of physical cutting tools and tool holders.
3	III	Locating and clamping devices.	Demonstration of physical locating and clamping devices in operation, video movies,
4	IV	Jigs and fixtures.	Demonstration with operations, video movies, Industrial visits.
5	V	Press tools.	Demonstration with operations, video movies, Industrial visits.
6	VI	Dies and mould.	Video movies, Industrial visits.

10. LEARNING RESOURCE

Sr.No.	Title of Book	Author	Publication
1	Donaldson Anglin	Tool Design	Tata McGraw Hill
2	A. S. T. M. E	Fundamentals of Tool Design	Prentice Hall of India
3	Kempster	Jigs & Fixture	E. L. B. S.
4	P. H. Joshi	Jigs & Fixture	Tata McGraw Hill
5	P. H. Joshi	Press Tools	Tata McGraw Hill
6	H. M. T.	Production Technology	Tata McGraw Hill
7	Amitabh Ghosh	Manufacturing Science	Tata McGraw Hill

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

Sr.No.	Resources with brief specification
1	Tool and cutter grinding machine.
2	Cutting tools, mainly set consisting assorted sizes of drill bits, set consisting assorted sizes of end mills, set consisting assorted sizes of side and face milling cutters, set consisting assorted sizes of centre drills-Type A and B, assorted carbide inserts,
3	Tool holders for carbide inserts, drill spindles/quills, milling machine quills.
4	Most commonly used set of locators and clamping devices, jigs and fixtures.
5	Models of jigs and fixtures.
6	Press-2.5 to 5 Tonnes,(Hydraulic or electrical operated), set of assorted sizes punches and dies,

12. LEARNING WEBSITE & SOFTWARE

a. http://www.psgdesigndata.org
b. http://www.carrlane.com
c. http://www.nptel.ac.in

13. MAPPING OF PROGRAMME OUTCOMES (Pos) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (Cos)

Sno	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Analyze metal cutting theory	3	3	2	3	-	2	-	-	-	2	-	3
2	Select proper tool for given manufacturing operation	3	3	2	3	-	2	-	-	-	2	-	3
3	Interpret designation system of cutting tool and tool holder.	2	3	2	2	-	-	-	-	-	2	2	-
4	Select locating and clamping devices for given component.	3	3	2	3	-	2	-	-	-	2	-	3
5	Select and design jig and fixture for given simple component.	3	3	2	3	-	2	-	1	-	1	-	3
6	Classify and explain various press tools and press tools operations.	2	3	2	3	-	1	-	-	-	1	-	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	N.S.Khandagale	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	S.V.Borde	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
3.	P.D.Shelke	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **POWER PLANT ENGINEERING**

COURSE CODE **6M411**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

The consumption of electrical energy per capita is universally accepted as a scale for measuring the living standard of a country. The demand for energy is increasing day by day and existing power generation capacity is inadequate to meet this increasing demand. Industries are expected to generate their own power and supply the excess power to national grid. Alternate energy sources are also harnessed to meet the increasing demand. Diploma engineers should know the layout, components of different power plants and economic aspects of power plants.

2. COMPETENCY

"Analyze, Repair, maintain and troubleshoot the different power plant equipment's and systems"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	-	-	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Get familiar with present and future power scenario of India.
2. Calculate efficiency of power generation cycles.
3. Analyze working of high pressure boilers, coal and ash handling systems of power plant.
4. Draw layout, understand the working and compare different power plants.
5. Identify sources of waste heat and determine method of heat recovery.
6. Explain constructional features of non conventional energy source devices.
7. Appreciate economical and operational aspects of power plants.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
UNIT NO: 1. Introduction to Power Plants	1a. Describe different power plants. 1b. Analyze various steam power cycles. 1c. Draw gas turbine cycle.	1.1 Power scenario in India 1.2 Types of power plants – Hydro, Nuclear, Thermal, Future trends in power sector. 1.3 Analysis of steam cycles- Carnot, Rankine, Reheat cycle, Regenerative cycle, Methods of reheating, Advantages and disadvantages of reheat cycle, 1.4 Gas turbine cycle.

Unit - II Steam Power Plant	2a. Draw layout of steam power plant. 2b. Explain working of Sub-critical and Super-critical boilers. 2c. Describe coal & ash handling systems. 2d. Analyze the environmental problems associated with the steam power plant.	2.1 Layout of steam power plant, general features of selection of site 2.2 High pressure boilers – Construction and working of Sub-critical and Super-critical boilers 2.3 Coal and ash handling system-equipments for in plant handling of coal such as belt conveyor, screw conveyor, bucket elevator, Coal crushing, Pulverized fuel handling system, Ball mill, Pulverized fuel and their advantages, Multi retort stoker, Pulverized fuel burner, Hydraulic and pneumatic ash handling, Electrostatic precipitator. 2.4 Boiler Feed water treatment 2.5 Environmental aspects of steam power plant - water pollution, air pollution, emission standard and its control
Unit - III Nuclear Power Plant	3a. Define fission reaction. 3b. Describe criteria for the selection of site for nuclear power plant. 3c. Explain different types of nuclear reactors. 3d. Compare different nuclear fuels & moderators. 3e. Enlist safety precautions for nuclear plants. 3f. Describe different nuclear power plants in India.	3.1. Fusion and fission reaction, layout and general criteria for selection of site. 3.2. Elements of nuclear power station, layout, types of nuclear reactors. 3.3. Nuclear fuels, coolant & moderators. 3.4. Working of PWR, BWR, CANDU, BREEDER, GCR, SGR, LMFBR type reactor. 3.5. Safety precautions and waste disposals. *3.6.* Nuclear power plants in India.
Unit - IV Gas Turbine Power Plants	4a. Draw general layout of gas turbine power plant. 4b. Describe parameters for selection of gas turbine power plant site. 4c. Explain components of gas turbine power plant.	4.1 General Layout, selection of site for Gas turbine power plants in India. 4.2 Components of gas turbine plants, gas turbine Fuels. 4.3 Environmental impact of gas turbine

	4d. Analyze the environmental impact of gas turbine plants.	power plant.
UNIT NO: V Sources of waste Heat	5a. Explain various methods of heat recovery. 5b. Explain the utilization of waste heat in various fields. 5c. Compare waste heat recovery boilers with conventional boilers.	5.1 Heat recovery forms & methods – Sensible and latent Heat recovery. 5.2 Use of waste heat- Agricultural, green house, Animal shelter, Aqua cultural uses, process heating. 5.3 Waste Heat recovery boilers
Unit – VI Non-conventional Power Generation Plants	6a. Explain geothermal power plant. 6b. Explain Tidal power plant. 6c. Explain Wind power plant. 6d. Explain solar power plant. 6e. Explain Magneto Hydro dynamic power plant. Explain small hydro power plant. 6f. Describe plasma technology.	6.1 Geothermal power plant-types, economical justification 6.2 Tidal power plant- factors affecting suitability of site, working of different tidal power plants, advantages and disadvantages 6.3 Wind power plant- different types, advantages and disadvantages. 6.4 Solar power plant 6.5 Magneto Hydro dynamic power plant 6.6 Small hydro power plant 6.7 Introduction to Plasma technology
Unit – VII Economic & Operational aspects	7a. Justify the selection of suggested power generation. 7b. Determine the number of generating units. 7c. Draw load duration curve. 7d. Estimate the cost & suggest suitable method to control it for the given power plant. 7e. Explain major electrical equipments used in any power station.	7.1 Prediction of load, selection of types of generation, number of generating units. 7.2 Load duration curves, cost analysis, elements, controlling the cost of power plant (simple numerical) 7.3 Major electrical equipments in power station- generator, step-up transformer, switch gear, electrical motors

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to power plant	08	02	04	02	08
II	Steam power plant	12	04	08	04	16
III	Nuclear power plant	14	02	08	06	16
IV	Gas turbine power plant	04	00	04	04	08
V	Sources of waste heat	06	02	04	04	10
VI	Non conventional power generation plants	10	02	04	04	10
VII	Economics and operational aspects	10	02	06	04	12
	Total	**64**	**14**	**38**	**28**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Visit to steam power plants/nuclear power plants/wind power plants/ Hydro power plants and prepare a report.	10
2	I	Collect information & Technical details of nuclear power plants.	04
3	II	Collect information & Technical details of Steam power plants	04
4	II	Collect information & Technical details of Solar & Wind power plants	04
5	II	Study of economic and operational aspects of power plants (simple	02

		numerical)	
6	III	Assignment on Coal & Ash Handling system	04
7	III	Assignment on Waste Heat recovery systems	04
Total			**32**

8. SUGGESTED STUDENTS ACTIVITIES

1. Prepare journals based on practical performed in laboratory.
2. Internet information on Survey on comparative technical data of different power plants
3. Collect information from net regarding power plant equipments and systems.
4. Collect information about uses, functions, designs of equipments.
5. Collect technical specifications
6. Enlist different routine maintenance procedures

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods including Chalk Board, LCD projector, Video Clips, etc.
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning
f. Computer Based Training Packages/Computer Aided Instructions Packages/CDs: For
    - Ash Handling System.
    - Gas Turbine and combined cycle power plant.
    - Power Station Safety.
    - Environmental pollution & pollution control.
    - Pulverizes and feeders.
    - Renewable energy sources

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Power plant Engineering	P. K. Nag	Tata McGraw Hill
2	Power plant Engineering	Fredrick T. Mosse	East-West press
3	A text book of Power System Engineering	A. Chkrabarti and M. L. Soni	Dhanpat Rai and Company
4	A course in power plant Engineering	Arora and Domkundwar	Dhanpat Rai and Company
5	Power plant Engineering	R.K. Rajput	Tata McGraw Hill

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Model or Chart & Videos of Hydro-electric Power Plant	As per curriculum
2.	Model or Chart & Videos of Thermo-electric Power Plant	As per curriculum
3.	Model or Chart & Videos of Nuclear Power Plant	As per curriculum
4.	Model or Chart & Videos of Wind Power Plant	As per curriculum
5.	Model or Chart & Videos of MHD Power Plant	As per curriculum
6.	Model or Chart & Videos of CHP	As per curriculum

12. LEARNING WEBSITE & SOFTWARE

a. https://btps.com
b. https://ptps.com
c. https://etps.com
d. https://chp.com
e. https://nhpc.com
f. https://ntpc.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

S.No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Get familiar with present and future power scenario of India.	01	01	01	02	03	01	02	-	02	02	02	-
2	Calculate efficiency of power generation cycles.	03	02	01	02	02	01	-	01	01	02	03	02
3	Analyze working of high pressure boilers, coal and ash handling systems of power plant.	02	02	01	02	02	01	01	01	01	02	03	01
4	Draw layout, understand the working and compare different power plants.	03	02	01	03	02	01	01	-	01	02	02	-
5	Identify sources of waste heat and determine method of heat recovery.	03	02	02	03	01	02	01	01	02	02	02	02
6	Explain constructional features of non conventional energy source devices.	03	02	02	03	03	01	02	-	01	02	03	01
7	Appreciate economical and operational aspects of power plants.	03	02	02	02	02	01	01	01	01	03	02	03

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr. U. V. Pise	Head of the Department, Govt. Polytechnic, Aurangabad
2	M. B. Sanap	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
3	R. N. Khadse	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **REFRIGERATION AND AIR CONDITIONING**

COURSE CODE **6M412**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	fifth

1. RATIONALE

The 21st century predicts revolutionary developments in Refrigeration and Air Conditioning. Refrigeration and Air conditioning is one of the most important job areas for diploma holders in Mechanical Engineering. Considering the wide and increasing use of Refrigeration and Air conditioning for domestic, commercial and industrial applications and the challenges put by the use of Refrigeration and air conditioning equipments in present stage, it is absolutely necessary that Diploma Engineers should learn this subject. They should know the processes, equipments, systems of Refrigeration and Air Conditioning with their functioning, maintenance, repairs and measures to meet the challenges of the near future in this area.

2. COMPETENCY

At the end of studying this course students will be able to

"Analyze, repair, maintain and troubleshoot the different Refrigeration and Air conditioning systems"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	0	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal, ~ online exam

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Describe types, working principles and construction of Refrigeration and Air Conditioning systems.
2. Calculate performance of refrigeration and air conditioning system
3. Enlist properties of refrigerants, their applications and effects on environment.
4. Identify various components and controls used in refrigeration and air conditioning.
5. Describe various refrigeration & air conditioning systems and their applications.
6. Estimate cooling and heating loads.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
UNIT : I. Basics of Refrigeration	1a. Differentiate conventional and non conventional methods of refrigeration 1b. Describe conventional and non conventional methods of refrigeration 1c. Describe Concept of heat engine, heat pump and refrigerator.	1.1 Definition of refrigeration. 1.2 Necessity of refrigeration 1.3 Methods of refrigeration:-Ice refrigeration, Refrigeration by expansion of air, Refrigeration by throttling of gas, Vapour refrigeration system, Steam jet refrigeration system. Non-conventional methods of refrigeration like Vortex tube, Pulse tube refrigeration, solar refrigeration 1.4 Concept of heat engine, heat pump and refrigerator. 1.5 Unit of refrigeration, C.O.P. and refrigerating effect.

Unit - II Refrigeration Cycles	2a. Describe reversed Carnot Cycle / representation on PV and TS diagram 2b. Describe Bell Coleman air refrigerator/ representation on PV and TS diagram 2c. Calculate COP using reversed Carnot cycle 2d. Draw and explain Vapour Compression Cycle/calculate COP 2e. Describe Vapour absorption Refrigeration system.	2.1 Reversed Carnot Cycle and its representation on PV and TS diagram. 2.2 Air Refrigeration Cycles: - -Bell Coleman air refrigerator, it's representation on PV and TS diagram, types and applications like air craft refrigeration using simple air cooling system.. - (Simple numerical on Reversed Carnot cycle.) 2.3 Vapour Compression Cycle : - -Principle,components, Representation on P-H and T-S diagram, effects of wet compression, dry compression, calculation of COP, Effect of superheating, under cooling, suction pressure and discharge pressure, Actual V.C.C., (simple numerical), Methods of improving COP (no description). -Introduction to multistage V.C.C., its necessity, advantages. 2.4 Vapour Absorption system : - Principle, components and working of aqua ammonia system (simple and practical) Li-Br Absorption System Electrolux Refrigeration System, Desirable properties of Refrigerant and absorbent used in Vapour Absorption System. 2.5 Comparison of above Refrigeration Cycles.
Unit - III Refrigerants	3a. Differentiate conventional and eco friendly refrigerants. 3b. Describe Green house effect and ozone layer depletion. 3c. Describe Global warming ODP & GDP. 3d. Apply the knowledge to	3.1. Classification of refrigerants. 3.2. Desirable properties of refrigerants. 3.3. Nomenclature of refrigerants. 3.4. Selection of refrigerant for specific applications. 3.5. Concept of Green House Effect, Ozone depletion, Global warming, ODP & GDP of refrigerants.

	select proper refrigerant.	3.6. Important thermodynamic properties of Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants etc
Unit - IV Equipment selection	4a. Describe Components used in VCS & VAS refrigeration System. 4b. Differentiate Compressors, Condensers, Expansion devices, evaporator and chillers. 4c. Apply the knowledge to select components for refrigeration systems	Components of Vapour Compression Refrigeration System 4.1 Compressors: Classification, Construction and working of open type, hermetic, centrifugal, rotary, screw and scroll compressor and their applications. 4.2 Condensers: Classification, description of air cooled and water cooled condensers, comparison and applications, Evaporative condensers. 4.3 Expansion devices: Types: - Capillary tube, automatic, thermostatic expansion valve and their applications 4.4 Evaporators and chillers: - Classification of evaporators Construction and working of Bare tube, Plate surface, finned, shell and tube, flooded and dry expansion evaporator Capacity of evaporator and their applications. Classification of chillers Construction and working of dry expansion Chillers, flooded chillers and their applications.
UNIT NO: V Psychrometry	5a. Describe properties of air on psychrometric chart. 5b. Draw and explain psychrometric chart. 5c. Select equipments used for conditioning of air	5.1 Definition and necessity of air-conditioning. 5.2 Properties of Air, Dalton's law of partial pressure

		5.3 Psychrometric chart 5.4 Psychrometric processes, Bypass Factor, ADP, concept of SHF, RSHF. 5.5 Adiabatic mixing of Air streams (simple numerical) 5.6 Simple numerical using Psychrometric chart 5.7 Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils.
Unit – VI Air- conditioning systems : Comfort conditions and cooling load calculations	6a. Differentiate air conditioning systems 6b. Describe human comfort, effective temp. and comfort chart 6c. Describe Components of cooling load- sensible heat gain and latent heat 6d. Distinguish sensible heat gain and latent heat gain sources	6.1 Classification of A.C. systems 6.2 Industrial and commercial A.C. systems 6.3 Summer, winter and year round A.C. systems 6.4 Central and unitary A.C. systems 6.5 Application areas of A.C. systems 6.6 Thermal exchange of body with environment 6.7 Factors affecting human comfort 6.8 Effective temp. and comfort chart 6.9 Components of cooling load- sensible heat gain and latent heat gain sources
Unit – VII Air distribution systems	7a. Draw and explain various duct systems 7b. Describe different equipments used for distribution of air. 7c. Select proper insulation for ducts.	7.1 Duct systems: - Closed perimeter system, extended plenum system, radial duct system, duct materials, requirement of duct materials, losses in ducts 7.2 Fans and Blowers: - Types, working of fans and blowers 7.3 Air distribution outlets: -Supply

		outlets, return outlets, grills, diffusers 7.4 Insulation: - Purpose, properties of insulating material, types of insulating materials, methods of applying insulation
Unit- VIII Application and advances in refrigeration & air-conditioning	8a. compare single door & double door freeze 8b. Design a cold storage from refrigeration point of view 8c Select capacity, components and controls for shopping mall AC system 8d Apply knowledge & skills in designing of dairy plant & Mobile van refrigeration	8.1 Technical features of double door refrigerator (freeze). Recent features like compressor type, capacity, refrigerant type, controls, commercial data 8.2 General considerations of Cold storage like its layout, plant capacity, components, refrigerants used, controls, pipings, insulations. Food items to be stored & their approximate preservation temperatures & humidity 8.3 AC systems used in shopping malls: Layout, piping, controls, refrigerants used, cost, plant capacity, etc. 8.4 Refrigeration systems in Dairy plants & mobile vans layout, plant capacity, components, refrigerants used, controls, pipings, insulations.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Basics of Refrigeration	6	04	06	-	10
II	Refrigeration Cycles	12	02	04	04	10
III	Refrigerants	6	02	04	00	06
IV	Equipment selection	12	04	04	04	12
V	Psychrometry	6	02	06	04	12
VI	Air- conditioning systems Comfort conditions and cooling load calculations	8	02	04	04	10
VII	Air distribution systems	6	02	04	02	08
VIII	Application and advances in refrigeration & air-conditioning	8	02	02	08	12
	Total	64	20	34	26	80

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I,II	a Demonstration of domestic refrigerator in View of construction, operation and controls used. b Study of various tools in refrigeration and air conditioning practice. c Demonstration of various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC. d Study of vapour absorption refrigerator	08

2	IV	a Identification of components of 'hermetically sealed compressor' for its study after dismantling and assembly. b Trial on water cooler test rig. c Actual gas charging of Domestic freeze or Car AC with use of required tools.	08
3	IV	. Dismantling & assembly of Reciprocating Refrigeration Compressor	02
4	VI	Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).	02
5	VI	a.Trial on A.C. test rig. b.Study of Split Air conditioner by observing actual split AC	04
6	IV VI	Trouble shooting of domestic refrigerator/window air Conditioner.	02
7	VIII	Visits (any two) to central A.C. plant in view of ducting system, insulation system and Air distribution system (e.g. frozen food industry/ Cold storage /ice- cream industry/Ice Plant/ Dairy Plant/ Shopping Mall AC plant	03
8	VIII	Visit to repair and maintenance workshop in view of use of various tools.	03
TOTAL			**32**

8. SUGGESTED STUDENTS ACTIVITIES

Following is the list of proposed student activities like:

1. Prepare journals based on practical performed in laboratory.
2. Solve numerical problems.
3. Collect information from manufacturer's catalogue and traders regarding refrigeration systems.
4. Interact with owner and list common troubles cold storages and Ice plants.
5. Collect information from market regarding uses of refrigeration and air conditioning equipments.

6. Collect specifications of refrigerators, air conditioners and deep fridgers..
7. Enlist different brand names of air conditioners and refrigerators and their capacities.
8. Internet Survey of Refrigerators & AC.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

Sr. No.	Name of Book	Author	Publication
01	Refrigeration and Air Conditioning	R.S.Khurmi	S.Chand and Co
02	Refrigeration and Air Conditioning	Arrora and Domkundwar	Dhanpat Rai and Sons
03	Refrigeration and Air Conditioning	Manohar Prasad	New Age Publications
04	Refrigeration and Air Conditioning	P.N.Ananthanarayanan	Tata McGraw Hill
05	Principles of Refrigeration	Roy Dossat	Pearson Education
06	Commercial Refrigeration	Edwin P. Anderson	Taraporevala Sons & Co
07	Practical Refrigeration	Audel	Taraporevala Sons & Co

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

Sr. No.	Name of equipment	Brief specification
1.	Water cooler test rig.	As per industry specification
2.	A.C. test rig.	As per industry specification
4	Reciprocating refrigerant compressor	As per industry specification
5	Hermetically sealed compressor	As per industry specification
6	Refrigeration test rig	As per industry specification
7	Window air conditioner	As per industry specification

12. LEARNING WEBSITE & SOFTWARE

a. https://voltas.in
b. https://godrej.com
c. https://lg.com
d. https://samsung.com
e. https://whirlpoolindia.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr. No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Describe types, working principles and construction of Refrigeration and Air Conditioning systems.	03	03	03	02	01	01	-	-	01	02	03	01
2	Calculate performance of refrigeration and air conditioning system	02	03	03	02	01	01	-	01	01	02	01	01

3	Enlist properties of refrigerants, their applications and effects on environment.	02	03	02	02	03	02	01	-	02	02	01	2
4	Identify various components and controls used in refrigeration and air conditioning.	02	03	02	03	01	01	-	-	02	03	02	02
5	Describe various refrigeration & air conditioning systems and their applications.	02	03	03	03	02	02	01	-	02	02	03	03
6	Estimate cooling and heating loads.	03	03	02	02	03	01	01	01	01	02	02	02

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	R. N. Khadse	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	M. B. Sanap	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
3	N.S.Khandgale	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **AUTOMOBILE ENGINEERING**

COURSE CODE **6M413**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

Automobile vehicles a now days are the inseparable part of modern life. The whole progress of the world is based on the development of modern automobiles. The diploma engineers must know about the principles of working, construction, maintenance of automobiles.. All the major global players in Automobile sector have launched their product in India. Automotive sector has major employment potential for diploma holders. Automobile servicing in particular offers good job opportunities at village, town & city level. This course in Automobile Engineering will make student understand & apply the knowledge about various system, subsystems & their inter-relationships.

2. COMPETENCY

At the end of studying this course students will be able to

"To understand different systems/sub-systems/components of the automobile vehicles with the view of maintenance and operation of the automobile".

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				3	1	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Differentiate various vehicle types and power generation options for automobiles..
2. Maintain the cooling, lubrication, ignition and fuel supply systems used in S.I and C.I engines.
3. Demonstrate major assemblies like clutch, gear box and differential.
4. Analyze electrical system and brake assembly.
5. Dismantle and assemble steering system and understand steering geometry.
6. Describe various tyres, suspension system and their maintenance

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Introduction of Automobile	1a. Give classification of automobile 1b. Draw different vehicle layout 1c. Explain frame & frameless chassis	1.1 Classification of automobiles 1.2 Vehicle layout & types-Front engine rear wheel, Rear engine rear wheel, Front engine front wheel, Four wheel drive 1.3 Chassis components 1.4 Frame & Frameless construction- 1.5 Function, Types of frame.
Unit - II Auto Engine Systems & Power plant(Engine)	2a. Give classification of engine 2b. Draw & explain different automobile power plant 2c. Describe functions of different engine components. 2d. Describe mixture requirement in petrol engine. 2e. Demonstrate construction & working of modern carburetors.	Power plant(Engine) 2.1 Engine classification-According to no. of cylinders, arrangement of cylinders. 2.2 Types of automobiles power plants-petrol, diesel, gas turbine, rotary piston engine, electric & hybrid vehicle

	2f. Analyze MPFI system. 2g. Describe mixture requirements in Diesel engine. 2h. Analyze CRDI systems 2i. Compare different cooling systems. 2j. Describe different lubrication systems.	2.3 Engine components-construction, function & material - Cylinder block, cylinder head, crankcase, oil pans, cylinder liners, gaskets, piston, piston pin, piston rings, connecting rod, crankshaft, valve & valve mechanism, timing gears, camshaft ,inlet &exhaust manifold, exhaust muffler Auto Engine Systems 2.4 Fuel feed system of petrol engine: Mixture requirement in petrol engine, modern carburettor, different systems in carburetor, Solex carburetor, MPFI system & its components 2.5 Fuel feed system of diesel engine: Mixture requirement in diesel engine, electrical pump, rotary fuel pump, fuel injector, governors, glow plug, common rail direct injection system(CRDI),Types of nozzles, 2.6 Cooling systems-Air cooling systems, liquid pressurized systems & components 2.7 Lubrication system- Different types like splash & pressurized, Oil pumps, filters, crankcase ventilation, Lubricants and additives
Unit - III Electrical Systems	3a. Describe construction of battery 3b. Select suitable battery charging methods 3c. Distinguish various ignition systems	3.1 Battery-principle & construction, rating of battery, charging methods, maintenance free battery 3.2 Ignition system-construction & working of battery , magneto & electronic ignition systems
Unit - IV Automobile Transmission	4a. Write necessity of clutch 4b. Demonstrate construction & working of various clutch 4c. Write necessity of gear box 4d. Compare various types of gear box. 4e. Give the importance of	4.1 Clutch- necessity, construction & working of coil spring, diaphragm spring clutch, multi plate clutch 4.2 Gear box- Necessity, constant mesh gear box, Synchromesh gear box, torque converter, overdrive 4.3 Final drive- propeller shaft& joints,

	differential 4f. Give importance & working of automatic gear box	action & need of differential, differential lock 4.4 Axle- front axle& types of rear axle 4.5 Concept of automatic gear box
Unit - V Steering Systems	5a. Draw & explain steering geometry 5b. Describe various steering gear boxes 5c. Justify the need of power steering	5.1 Steering geometry-camber, castor, king pin inclination, toe-in, toe-out, under steering, over steering, turning radius 5.2 Steering Gear box- rack &pinion type, recirculating ball type, worm & roller type 5.3 Wheel balance procedure 5.4 Power steering (hydraulic & electrical)
Unit – VI Brakes	6a. classify automotive brakes 6b. Compare various brakes 6c. Analyze ABS in detail	6.1 Classification of brakes 6.2 Principle construction & working of drum & disc brake 6.3 Construction & working of hydraulic, air braking systems, power brakes 6.4 Concept of anti-lock braking system.
Unit– VII Wheels Tyres & Suspension	7a. Classify types of wheels and tyres. 7b. Describe construction & working of various suspension system 7c. Select suitable shock absorber for automobile	Wheels tyres & Suspension 7.1 Types of wheels 7.2 Tubeless tyre & radial ply tyre 7.3 Types of suspension-rigid axle suspension, independent suspension such as Macpherson strut, wishbone types, air suspension system 7.4 Telescopic hydraulic & gas filled shock absorber.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction of Automobile	06	02	02	04	08
II	Auto Engine Systems & Power plant(Engine**)**	18	04	16	04	24
III	Electrical systems	08	02	02	04	08
IV	Automobile Transmission	08	02	04	04	10
V	Steering Systems	08	02	06	02	10
VI	Brakes	08	02	06	02	10
VII	Wheels Tyres & Suspension	08	02	06	02	10
	Total	**64**	**16**	**42**	**22**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

S. No.	Unit No.	**Practical Exercises** (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Demonstrate automobile chassis & locate different systems and components on the chassis	02
2	II	Dismantle & assemble four stroke engine. Observe & sketch various components	04
3	II	Dismantle & assemble solex carburetor & observe different systems.	02
4	II	Demonstrate & analysis of MPFI system of car like Maruti, Indica or Hyundai	02
5	III	Demonstration of Magneto ignition system of two wheeler .Observe & sketch various components	02
6	IV	Demonstration of single plate coil spring & diaphragm spring type clutch	02
7	IV	Dismantle & assemble of synchromesh gear box.	04

8	V	Observe the steering system. Open the steering gear box and sketch the components.	04
9	VI	Observe & draw layout of hydraulically operated braking system.	02
10	VII	Observe different suspension systems	02
11		Visit to four- wheeler service station & prepare a report	02
12		Mini project :- Collect following information from Internet/magazine/company manuals etc a) New models of cars launched in last 3 years. Study modern features in these vehicles b) Safety devices in modern automobiles c) Pollution norms-Euro & Bharat stage IV	04
		Total	**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

Following is the list of proposed student activities:

1. Prepare journals based on assignments.
2. Prepare the models of various vehicles.
3. Observe the locations of various systems\components in the vehicle.
4. Observe the locations of various components of engines.
5. Visit to a small automotive service station.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

Sr No.	Title of Book	Author	Publication
1	Automobile Engineering	Kirpal singh Vol I and Vol II	Standard publications
2	Automobile Engineering	R.B. Gupta,	Satya Prakashan New Delhi
3	Internal Combustion Engines	Mathur and Sharma,	Dhanpat rai and Sons
4	Automotive Technology	H.M.Sethi	Tata McGraw hill
5	Automobile Engineering	G.B.S. Narang	Khanna Publication
6	High Speed Internal Combustion Engines	Ricardo	Dhanpat rai and Sons
7	Automobile Engineering	K. K. Jain and R.B. Asthana	Tata McGraw hill
8	Automobile Engineering	R.P.Sharma,S.CHAND	Dhanpatrai & sons

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr.No.	Name of the Equipment	Specification
1	Four stroke petrol engine.	As per specification
2	Four stroke diesel engine.	As per specification
3	Two stroke petrol engine.	As per specification
4	Cut section medel of a car	As per specification
5	Single plate clutch of a car	As per specification
6	Solex carburetor.	As per specification
7	MPFI system of car like Maruti ,Hundai, Indica	As per specification
8	Battery and Magneto Ignition systems.	As per specification
9	Exhaust gas analyzer	Measures O2, CO, NOx (NO + NO2 separate), SO2 – high precision and long-term stable Accuracy tolarance : 1 %
10	Steering system assembly	As per specification
11	Brake system assembly	As per specification
12	Model of suspension system	As per specification

12. LEARNING WEBSITE & SOFTWARE

a https://www.nptel.ac.in/courses
b https://www.k12reader.com
c. https://www.eduaction.com
d. https://www.k5learning.com
e. https://www.english4u.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Differentiate various vehicle types and power generation options for automobile's	2	3	2	2	1	1	1	-	-	1	2	-
2	Maintain the cooling, lubrication, ignition and fuel supply systems used in S.I and C.I engines.	1	2	2	3	1	2	1	1	-	2	2	2
3	Demonstrate major assemblies like clutch, gear box and differential.	2	2	2	2	1	1	1	-	1	1	2	-
4	Analyze electrical system and brake assembly	2	3	2	3	2	1	-	-	-	2	2	1
5	Dismantle and assemble steering system and understand steering geometry.	2	2	2	3	1	-	-	1	-	1	1	-
6	Describe various tyres, suspension system and their maintenance	2	3	2	2	3	1	1	2	1	2	3	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Prof. V. B. Kumawat	Lecturer in Mechanical Engineering Department
2	Prof.N.S..Khandagale	Lecturer in Mechanical Engineering Department

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **3 D MODELING**

COURSE CODE **6M405**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

Rapid development of Technology and competitive economy, demands frequent changes in product design to suit the customer's needs. Computers play very important role in modeling any complex part and incorporating frequent changes as per customer requirements and further which can be extended up to CAM, CIM ,PLM and simulation etc.

Moreover, today's market is compelling design/consulting engineering firms and manufacturing companies to seek CAD conversion of their existing paper based engineering documents. Hence it is essential for a Diploma Technician to have a skill in operating different 3 D modeling software's practiced in Industry such as Pro-E, Catia, SolidWorks, SolidEdge, Autodesk Inventor etc.

The focus of this course is to provide the students with hands-on experience in developing 3D models, assemblies & producing Industrial production drawings and also making them competent in latest solid modeling and assembly practices.

2. COMPETENCY

"Develop 3 D part models & assemblies of Mechanical systems and prepare its Production drawings using any 3 D Modeling software.

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	75
1	-	2	3	--	--	25#	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive

Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. To draw sketches using appropriate constraints.
2. To develop 3 D part models by using various feature tools.
3. To develop assembly from 3 D part models by applying various mating constraints.
4. To prepare production drawings from 3 D part models & assemblies.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit –I Introduction to GUI(Any 3 D Modeling software)	1a. Know the various tool bars and various commands for sketching, view, feature annotation etc. 1b. Understand the use of property manager, feature manager, design manager and configuration manager.	1.1 Tool bars: Standard Toolbar, Sketch Toolbar, Relationship Toolbar, View Toolbar, Drawing Toolbar, Feature Toolbar and Annotation Toolbar. 1.2 Feature Manger Design Tree: Design Manager, Property Manager, and Configuration Manager. 1.3 Selection Method: Selection from design Tree, Graphic Area.
Unit– II Sketching	2a. Understand the sketching, editing and modification of sketch. 2b. Knowing how to add relations, dimensions, aligned, angular, and circular sketches	2.1 Sketch Plane, grid, units, edit and modify sketch. 2.2 Sketch relations: Adding and changing geometric relations 2.3 Dimensioning: Vertical, horizontal, aligned, angular, circular sketches. 2.4 Reference Geometry: Creating axis, creating reference planes

Unit– III Part Modeling	3a. Understand the concept of creating features and modify a feature by means of various tools. 3b. Understand how to create feature patterns through sketches.	3.1 Creating Features such as extrude, Cut Extrude, Holes, Revolve, Shell, Loft, Sweep, 3.2 Modifying a feature using draft, Fillet, Chamfer, and Hole Wizard. 3.3 Creating Feature Pattern: Circular Pattern, Rectangular Pattern, Through Sketch
Unit– IV Editing and modifying a part model	4a. Understand the use of design tree for feature definition and editing. 4b. Learn to use editing the sketch of a part model 4c. Learn how to the various tools to suppress, rollback, change color and mass properties.	4.1 Feature Manager Design Tree, Editing a Feature definition, 4.2 Editing sketch of the part model, Move and copy Features, 4.3 Suppress, Rollback, Part color, Mass properties.
Unit - V Assembly	5a. Know the conventions in feature manager design tree and understand its use in assembly of components. 5b. Know and understand the various tools used in assembly modeling 5c. Know the procedure of calling a part model from the library.	5.1 Assembly Toolbar, Feature Manager design tree conventions, 5.2 Mate components, align, concentric, parallel. 5.3 Calling part model into assembly from library
Unit – VI Drawing	6a. Know the different types of standard templates and use them to create drawings 6b. Learn how to add different orthographic views on a drawing sheet. 6c. Know and understand the feature to be added like dimensions, center marks, bill of material etc. 6d. Understand the procedure	6.1 Creating Drawings: standard templates, Sheet setup, 6.2 Adding drawing views: standard three views, Sectional views, auxiliary views, detailed views. 6.3 Annotations: adding dimensions, notes, centre marks, Bill of Material, 6.4 Page Setup, Print selection, print preview, and Print a document

	of printing and plotting a part or assembly drawing.	

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Introduction to GUI (Any 3 D Modeling software)	02	--	--	--	NA
II	Sketching	03	--	--	--	NA
III	Part modeling	03	--	--	--	NA
IV	Editing and modifying a part model	03	--	--	--	NA
V	Assembly	03	--	--	--	NA
VI	Drawing	02	--	--	--	NA
	Total	16	--	--	--	NA

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	II	Draw the sketches of the machine parts (Any Three from given set)	04
2	III	Creating parts using features extrude, cut, rib, revolve, chamfer, fillet (Any Three from given set)	06
3	III	Creating parts using, sweep, loft, draft. (Any Two from given set)	06
4	IV	Part modeling using reference axis and planes, editing and modifying the parts, patterns circular and rectangular. (Any Two from given set)	04

5	V	Creating assemblies of the parts designed. (Any one from given set)	04
6	VI	Creating drawing views of the parts (Any Two from Unit no. I to IV) and the assembly. (Unit V)	04
7	VI	Plotting the Drawings with dimensions and annotations	04
		TOTAL	**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular students activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1. Prepare journals based on practical's performed in laboratory.
2. Carry out market survey for various 3 D modeling software's used in industry.
3. Analyze the specifications, costs, quality and limitations for various types of 3 D modeling software's.
4. Collect the information about the features of various 3 D modeling software's.
5. Collect the specifications of printers & plotters of different manufacturer required for CAD work/job
6. Search online PPT's, PDF's, and videos on the use of CAD/CAM software's used in industry.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Arrange visits to industries and demonstrate various software's used in 3 D modeling and assembly modeling.
b. Motivate students to use the software's available and prepare the models for a given assembly.
c. Arrange expert lectures of suppliers of various software's available in the market.
d. Q & A technique.
e. Activity based learning.

10. SUGGESTED LEARNING RESOURCE

Sr. No.	Name of Book	Author	Publication
1.	3 D Modeling using Solid Works	-	Lab Manual Developed by G. P. Aurangabad
2.	CATIA V5R14 for Designers	Sham Tickoo	Softcover, Cadcim Technologies (ISBN No 1-932709-08-8)
3	Pro/Engineer Wildfire for Designers	Sham Tickoo	Softcover, Cadcim Technologies (ISBN No 1-932709-03-7)
4	Solid Works For Designers Release 2004	Sham Tickoo	Softcover, Cadcim Technologies (ISBN No 0-9663537-9-X)
5	Autodesk Inventor for Designers: Release 10	Sham Tickoo	Softcover, Cadcim Technologies(ISBN No 1-932709-09-6)
6	Engineering Analysis and Optimization using CAD software	Chougule N.K.	SCITECH publications (ISBN No 9789385983245)

11. **LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED** :

Sr. No.	Name of equipment	Brief specification
1.	PCs -20 Nos. with networking	O.S. : Windows 7 64-bit 4GB or higher CPU: Intel Pentium (4, M, D) Intel Xeon Intel Celeron Intel Core AMD Athlon AMD Opteron Note: Single-, dual- and quad-core processors are supported. RAM: 4 GB Browser: Internet Explorer 9.0 and later, and Mozilla Firefox 10.0.1 and later. Monitor: 1280 x 1024 (or higher) resolution support with 24-bit or greater color Network: Microsoft TCP/IP Ethernet Network Adapter Mouse: Microsoft-approved 3-button mouse
2.	CAD/CAM software	20 seats of latest software such as SolidWorks /Pro-E/SolidEdge/Mechanical Inventor etc.
3.	Plotter	01- As per make specification preferably HP.

12. LEARNING WEBSITE & SOFTWARE

a. https://www.solidworks.com/sw/products/3d-cad/packages.htm
b. http://www.3ds.com/products-services/solidworks/
c. https://www.youtube.com/user/solidworks
d. https://www.solidworks.com/sw/resources/solidworks-tutorials.htm
e. http://www.solidworkstutorials.com/
f. http://www.solidworks.in/sw/docs/Student_WB_2011_ENG.pdf
g. http://globalsite.solidworks.com/files/2008_2009-advanced-modeling-workbook_lr-1.pdf
h. https://www.youtube.com/watch?v=6glpCzXvCbw
i. https://www.ptcusercommunity.com/thread/32015
j. http://www.econocap.com/userData/econocap/doc/installproe.pdf
k. http://www.ptc.com/community/landing/wf3.htm
l. http://www.proetutorials.com/FreeTutorials.htm

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

SNo	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	To draw sketches using appropriate constraints.	-	3	3	2	-	-	-	3	2	2	-	2
2	To develop 3 D part models by using various feature tools.	-	3	3	2	-	-	-	3	2	2	-	2
3	To develop assembly from 3 D part models by applying various mating constraints.	1	3	3	3	2	1	1	3	2	3	3	3
4	To prepare production drawings from 3 D part models & assemblies.	1	3	3	3	2	1	1	3	2	3	3	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	V.M.Bukka	Lecturer in Mechanical Engg. Department, Govt. Polytechnic, Aurangabad
2	S.B.Kulkarni	Lecturer in Mechanical Engg. Department, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **SEMINAR**

COURSE CODE **6M501**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Fifth

1. RATIONALE

A technician is responsible for handling various resources like Man, Material, Machine and, proper maintenance of different Mechanical machines in various areas of Mechanical engineering. While working in the industry a technician is employed for planning, preparation, supervision, and quality control. Arrangement and handling of materials, labours and equipment's are also the role of a technician. Seminar will help in enhancing the knowledge & skills of the technicians in recent advancements in Mechanical Engineering and also improves presentation and communication skills.

2. COMPETENCY

At the end of studying this course students will be able to

"Handle human resources and communicate effectively in Mechanical Engineering profession."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	75
-	-	2	2	--	--	50@	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Student should become professionally competent.
2. Possess effective communication and presentation skills.
3. To create awareness about latest technological aspects.
4. To improve skills related to searching on internet.
5. To realize importance of basic technological aspects.

5. DETAILED COURSE CONTENTS

Student studying in Final year Mechanical Engineering program has to select topic for seminar presentation of his/her interest under guidance of teaching faculty members , which shall be finalized by guide and approved by concerned Head of department.

1 Student has to prepare and submit short (One Page) abstract of the selected seminar topic. Further guidance shall be give the allotted faculty members.

2 Finally the students shall prepare the report of his seminar under the guidance of the teaching staff members (Maximum 35 pages) which may consists of observations, drawings, sketches, sample calculations / simple designs, processes, procedures, applications, managements, and costing aspects if necessary.

3 Student should deliver a seminar for 10 to 15 minutes preferable by ppt / model / charts etc. of his selected topic followed by question and answer session of 5 minutes.

4 Evaluation will be done on the basis of Seminar topic, contents, communication presentation skills and response to questions asked at the end of presentation.

6. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	1	**Term work** Identify the topic related to Mechanical Engineering field/ construction industry.	04
2	2	Literature survey And Analysis of data collected.	08
3	3	Identify methodology, do comparative study of various methods, identify related case study.	08
4	4	Preparing rough draft along with collected drawings. maps and designs / calculations or tables etc.	04

5	5	Prepare Final draft with attachments. Binding and term work completion.	04
6	6	Presentation in presence of guide and external examiner.	04
		Total Hours.	**32** hrs

7. SUGGESTED STUDENTS ACTIVITIES

I) Aspects to be considered for report writing

- To study recent developments and technological advances in Mechanical Engineering field.
- Develop the Entrepreneurial skills.
- Develop communication skills.
- To enhance the presentation skills
- Seminar reports preparations & cost analysis,

II) SUGGESTED AREAS FOR THE SEMINAR FOR MECHANICAL ENGINEERING PROGRAMME:

SR. NO	AREA OF MECHANICAL ENGINEERING	SUGGESTED TOPICS
1	Materials	Smart materials. Materials used for aero-space mfg. industry. Materials used for marine industry. engg. Application of non-ferrous & ferrous materials. Heat treatment of materials.. Application of nonmetals. Manufacturing of steels. Powder metallurgy.
2	Mechanical Engg. Components.	bearings, couplings, shafts ,springs, gaskets. Heat exchanger, filters.
3	Theory of machines	Vibration, cams & followers. Mechanisms**.**
4	Fluid mechanics techniques	Advance flow measuring techniques.

5	Measurement and control.	Study of various controllers. Advanced measurement technique.
6	Manufacturing/ Tool Engg.	Advanced welding techniques, CNC machines, SPM non-conventional machining processes., advanced cutting tool materials, advanced jigs and fixtures ,advanced manufacturing systems.
7	Quality management	TQM,TPM,5'S,Kaizen,Six-sigma,quality,JIT,kanban,poka yoke,cellular mfg system circle, lean mfg. agile manufacturing, CMM
8	Thermal field	Compressors turbine ,jet propulsion, rocket propulsion ,power plant, fuel cells, cold storage, ice plant AC system of commercial building., refrigeration & air conditioning service/maintenance & tools, energy conservation, solar energy, wind, geothermal, biomass energy.
9	Mechatronics	Sensors, Automation, Robotics.
10	Automobile	Lubricants & additives, coolants, power-steering, MPFI,CRDI system, vehicle testing, automobile sensors, environmental pollution control, alternative fuels ,automobile safety, maintenance free battery, wheel alignment and balancing,anti-lock braking system, independent suspension system, LPG, CNG,hybrid vehicles, aqua vehicles.Automatic gear box,

8. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

1. Do literature survey and identify area of interest for seminar preparation.
2. Visit the site if required.
3. Search on internet for information gathering.
4. Prepare sketches, layouts in AUTOCAD if required.
5. Collect drawings and prepare estimates if needed.
6. Do comparative study of methods, identify case study etc
7. Prepare report of seminar as per above instructions.
8. Prepare power point presentation of Seminar topic.

SEMINAR REPORT FORMAT

1. Seminar report shall be in the print form on A-4 size white bond paper.
2. Typing shall be in Times New Roman with spacing of 1.5 using one side of paper.
3. Margins: Left = 37.5 mm Right , Top and Bottom = 25mm.
4. Front page : Titles - TNR 18 bold , other – TNR 14 bold. With Institute Logo.
5. Inner Pages : Titles –TNR – 14 Bold , other TNR 12 .
6. Page Nos :Should appear on the right hand top corner of each page starting after index page.
7. Tables to be preferable in the Text format only.
8. Sketches to be drawn on separate sheet / pages in black ink .
9. The Last content in the index to be of references. Acknowledgement to be added in the report.
10. Binding: Spiral binding is preferred for the seminar report. The number of copies are to be prepared by the student are 3 nos. (Student + Guide + Department copy)

9. SUGGESTED LEARNING RESOURCE

Visit to institute library to find the related text books.

Sr. No	Title of Book	Author	Publication
1	As per industry details / area of Seminar	Related reference books / I.S. codes , Hand books etc	Under guidance of faculty members.

10. Major Equipment/ Instrument with Broad Specifications

1. Demonstrations / Explanations in industry by experts and faculty.
2. Observations and collections from field

11. Learning Websites

Search on WEB for related construction sites. Take guidance from faculty members.

12. LEARNING WEBSITE & SOFTWARE

1.www.google.com
2.www.youtube.com
Websites related to seminar topic

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	Programe Out comes										PSO		No. of hours allocated in curriculum
		1	2	3	4	5	6	7	8	9	10	1	2	
1	Student should become professionally competent.	--	3	--	3	--	--	--	---	--	--	--	2	06
2	Possess effective presentation and communication skills.	--	1	--	---	--	--	--	---	---	--	--	2	06
3	To create awareness about latest technological aspects.	---	---	3	3	---	---	--	1	--	--	1		08
4	To improve skills related to searching information on internet.	--	2	3	--	--	--	---	--	--	--	2	2	04
5	To realize importance of basic technologies.	--	3	--	--	--	--	--	2	--	--	2	2	08

Course Curriculum Design Committee

Sr. No	Name of the faculty members	Designation and Institute
1.	Smt.J.S.Patil	Head of Department Civil Engg. Govt. Polytechnic, Aurangabad.
2.	Shri. Y.N.Shaikh	Lecturer in Civil Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INDUSTRIAL ORGANIZATION AND MANAGEMENT**

COURSE CODE **6G305**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
ME/EE/CE/AE/ET/CO/IT	Fifth / Sixth

1. RATIONALE

Diploma graduate works at middle management level in the industries/engineering organizations. Therefore he has to be proficient in planning, organizing & coordinating various activities of industries/ organizations or when he is required to work in different types of projects. They are also expected to deal with workforce and management problems. In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. Quality and cost controls are also other important factors which contribute to the day to day supervision issues. This course aims to deal effectively with such issues along with familiarization of acts and laws applied to industries.

2. COMPETENCY

At the end of studying this course students will be able to

"Plan, organize and Coordinate various activities/ processes in industry/projects by ensuring optimal use of resources"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE@ (PR/OR)	PA (TW)	125
03	-	02	05	80	20	-	25	
Duration of the Examination (Hrs)				02 (Online Exam)	01	-	-	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR –Oral Examination, TW - Term. Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Identify the different sector and industry of given company name.
2. Plan, organize and Coordinate various activities in industry or a project.
3. Ensure proper management of human resources.
4. Identify the need of finance and its optimal use in an organization.
5. Manage materials &stores.
6. Apply PERT/CPM method for project scheduling of given project
7. Apply marketing strategies to promote the sales & services.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics **(Containing POs and PSOs assignment in each Sub-topic)**
Unit – I Business overview	1a Classify businesses. 1b Outline the impact of Globalization and IPR on business. 1c Identify& need of e-commerce.	1.1 Type of sectors. Service, Manufacturing, Trade. 1.2 Globalization and IPR- Introduction, Advantage and Disadvantage w.r.t India. 1.3 e - Commerce: Merits and Demerits.
Unit - II Evolution of Scientific Management.	2a Outline the historical perspective of management. 2b Identify the functions of management. 2c Develop organization structure. 2d Select appropriate form of ownership.	2.1 Evolution of management thoughts. 2.2 Definition of management, Levels of management. 2.3 Scientific management by F W Taylor. 2.4 Administration Vs. Management 2.5 Henry Fayol's 14 Principles of management. 2.6 Functions of management - Planning, Organizing, Staffing, Directing & controlling 2.7 Types of organization- Line, Line & Staff, Functional & Project. 2.8 Centralization and Decentralization. 2.9 Forms of Ownership- Proprietorship, Partnership, Joint Stock Company, Co-operative society & Government Sector.
Unit –III Personnel Management & Legislative Act.	3a Identify & develop human resource 3b Apply strategies of motivation. 3c Practice safety procedure 3d Identify the features of industrial	3.1 Definition, Objectives and Function of Personnel management 3.2 Recruitment & Selection Procedure 3.3 Training & its type: Induction, Skill Enhancement & Motivational Training.

	acts.	3.4 Leadership & its styles. 3.5 Motivation-Definition, its type & Maslow Theory 3.6 Safety management: Causes of Accident and Safety procedure 3.7 Salient Features of (Introduction, Objective, Scope, Important definition & Related provision) 1 Indian Factory act 1948. 2 Industrial dispute acts 1947. 3 Workmen compensation act 1923. 4 The employees state insurance Act 1948. 5 Contract Labour Act.
Unit- IV Financial Management	4a Identify sources of finance 4b Prepare budget. 4c Acquaint with prevailing taxation policy.	4.1 Objectives & Functions of financial management. 4.2 Capital, Types of Capitals-Fixed & Working Capital 4.3 Direct Cost & Indirect Cost 4.4 Sources of raising Capital- Internal & External sources. 4.6 Introduction of budget & budgetary control. 4.7Production Budget (including Variance Report) 4.8Labour Budget 4.9Introduction to Profit & Loss Account (only concepts) 4.10Introduction of Income Tax & GST (Good & Service Tax)
Unit - V Materials Management	5a. Plan Inventory for processes. 5b. Calculate EOQ. 5c. Practice purchase procedure.	5.1 Objective and function of material management. 5.2 Inventory – Concept, its Classification & Objective. 5.3 Economic Order Quantity (EOQ) - Concept & Graphical Representation. 5.4 ABC Analysis- Definition & Step of ABC Analysis. 5.5 Purchase Procedure 5.6 Overview of ERP, JIT, 5's, Kaizen& six sigma (Introduction, Objective & Benefit).
Unit -VI Project	6a Use CPM/PERT for project scheduling for execution. 6b Track the project with the help of	6.1 Introduction of Project Management, project Network Analysis 6.2 Concept and introduction of CPM/PERT. 6.3 Solving simple network using CPM/

Management	project management techniques.	PERT 6.4 Concept of Breakeven analysis. 6.5 Progress tracking charts-bar charts, Gantt charts and histogram.
Unit - VII Marketing Management	7a. Apply marketing strategies.	7.1 Objective & Function of marketing management 7.2 Sellers and Buyers markets, Marketing, Sales, Selling vs. Marketing, Sales promotion, Marketing Mix, Pricing Policies. 7.3 Marketing Strategies: Segmentation, Targeting & Positioning. 7.4 Marketing Information System.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Business Overview	03	02	04	00	06
II	Evolution of Scientific Management	09	04	10	00	14
III	Personnel Management & Legislative Act	11	04	10	04	18
IV	Financial Management.	07	04	06	02	12
V	Materials Management	06	04	04	02	10
VI	Project Management	07	02	06	04	12
VII	Marketing Management	05	02	04	02	08
	Total	**48**	**22**	**44**	**14**	**80**

Legends: *R– Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/ programme outcomes. Following is the list of practical exercises for guidance.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

The tutorial/practical/exercises should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

1. Identify the different sector and industry of given company name.
2. Plan, organize and Coordinate various activities in industry or a project.
3. Ensure proper management of human resources.
4. Identify the need of finance and its optimal use in an organization.
5. Manage materials &Stores.
6. Apply PERT/CPM method for project scheduling of given project
7. Apply marketing strategies to promote the sales &services.

S. No.	**Unit No.**	**Practical Exercises** (Outcomes in Psychomotor Domain)	**Approx. Hrs. required**
		Part A- Common to all Programme	
1.	I	To collect data / information and prepare report about business/organization and identify the nature of business and prepare organization structure.	04
2.	III	Identify and propose Safety requirements/ mechanism for an industry.	04
3	V	Prepare a report of inventory by visiting stores of an industry/organization.	02
4	VI	Prepare network diagram using CPM& PERT (3-4 networks each) for identified Projects	04
5.	IV/VII	Undertake Survey/Data Collection, Presentation and Data interpretation for following. (Any One) a. Sales Promotion. b. Channel of Distribution c. Capital Generation & Management	04

		Part B- Programme Specific Practical for CO/IT/ET/EE/ME/AE (Five Numbers)	
6	III	Prepare a report on Human Resource (HR) policies used in Multinational companies	02
7	IV	Give presentation (PPT) on various Financial budgets of any company	02
8	IV/V/VII	Data collection on i) GST ii) Six sigma iii) Market segmentation	02
9	VII	Discuss Global marketing strategies by making small presentation (PPT).	04
10	All Units	Micro Project (visit to an industry, observe & prepare a report on various management techniques adopted by the company)	04
Total			**32Hrs**
		Part B- Programme Specific Practical for Civil Engineering (Five Numbers)	
6	III	Prepare a small report on Human Resource (HR) policies used in any Multinational companies/infrastructure development company/manufacturing of civil engineering materials.	02
7	VI	Prepare a bar chart of construction activities of bunglow / residential building.	02
8	V	Study and collection of various records pertaining to store like Goods received sheet, store indent, priced store ledger, register of materials at site account, statement of receipts, issues& balance of road metals, cement register etc.	02
9	II/III/V	Group Discussions and report writing on (Any one form following or likewise) 1) Modern Techniques of material Management 2) Causes of Accident and safety management. 3) Production and Labour budget	04
10	All Units	Micro Project (visit to an PWD/WRD/Large private construction organization/infrastructure development company to observe & prepare a report on construction management techniques/working adopted by the organization)	04
Total			**32Hrs**

8. SUGGESTED STUDENTS ACTIVITIES

Sr No	Activities
1	Prepare a group of five students and write qualities of a good leader.
2	Prepare a group of 10 students and conduct a group activity like housekeeping of a class room.
3	Draw a network for given set of activities and identify the critical path
4	Calculate the total time required to accomplish a task when t_e, t_p and t_m is given.
5	Visit to nearest ESIC office and collect information about services provided by ESIC office to the working employees.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

Sr No.	Unit no.	Unit name	Strategy
1	1	Business Overview	Live explanation, videos.
2	2	Evolution of Scientific Management	Live explanation, , case study
3	3	Personnel Management & Legislative Act	Live explanation, movie, case study
4	4	Financial Management.	Case study, survey, industrial visits
5	5	Materials Management	Net survey, Case study, industrial visits
6	6	Project Management	Net survey, Case study, industrial visits
7	7	Marketing Management	Net survey, Case study, industrial visits

10. SUGGESTED LEARNING RESOURCE

Sr No.	Title of Book	Author	Publication
1.	Industrial Organization and Management	O.P.Khanna,	DhanpatRai and Sons
2.	Industrial Organization and Management	Banga and Sharma,	Khanna Publications
3.	Modern Business Organization & Management	S.A.Sherlekar& V.A. Sherlekar,	Himalaya Publications

LEARNING WEBSITE & SOFTWARE

1. https://mitpress.mit.edu
2. http://iveybusinessjournal.com/publication/a-new-role-for-management
3. https://en.wikipedia.org/wiki/Project_management
4. http://www.pmi.org.in/

11. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs)

SR No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Identify the different sector and industry of given company name.	-	-	-	-	3	-	-	1	-	-	3	-
2	Plan, organize and Coordinate various activities in industry or a project	3	3	2	-	3	-	-	1	-	-	3	-
3	Ensure proper management o human resources.	2	3	-	2	3	-	-	1	-	-	2	2
4	Identify the need of finance and its optimal use in an organization	3	3	-	2	-	-	-	-	-	1	3	3
5	Manage materials & Stores	2	3	-	3	-	-	-	-	-	-	3	-
6	Apply PERT/CPM method for project scheduling of given projec	1	3	-	3	-	-	-	-	-	2	3	2
7	Apply marketing strategies to promote the sales &services.	-	3	-	3	-	-	2	2	-	2	3	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A. B. Deshpande	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad
2	K.S. Borde	Lecturer in Civil Engineering, Govt. Polytechnic, Aurang
3.	P.B. Lahoti	Lecturer in Computer Engineering, Govt. Polytechnic, Aurangabad

COURSETITLE PRODUCTION ENGINEERING

COURSE CODE 6M506

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	**Semester in which is offered**
Mechanical	Sixth

1. RATIONALE:-

In changing industrial scenario the importance of productivity is becoming more and more crucial. A diploma engineer working at lower level management in industries, they play a vital role in above aspects. Developing a positive attitude in employees towards the productivity is crux of industrial engineer. A supervisor can achieve highest level of productivity by using proper workplace layout, proper methods of processing. At the same time principles of motion economy reduces stress and fatigue in workers.The Diploma pass-out should be employable as an Industrial Engineer, well acquainted with recent trends in the area of Industrial Engineering and should ensure productivity in all level of supervision.

2. COMPETENCY:-

"Inculcate capability to transmit objectives and plans of management in day to day operations and continuously monitor them."

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	125
3	-	2	5	80	20	-	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **PR**-Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Test; **OR**-Oral examination,~ Online examination.

4. COURSE OUTCOMES:

1. Apply productivity improvement tools at all levels of workplace by using principles of industrial engineering.
2. Analyze different types of plant layout & material handling equipments
3. Conduct a time study and Method study toestablish the improved methods of doing a work.
4. Calculate Standard and basic time by using PTS.
5. Comment the emerging trends in Production Engineering.

5. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I Productivity	1a Understand theimportance ofproductivity. 1b Identify the factors & techniques contributing productivity Improvement. 1c coordinate the available resources of enterprise.	1.1 Productivity- Concept, benefits of higher productivity. Productivity at enterprise level. • Approach 1: Total productivity factor. • Approach 2: total factor productivity. • Approach 3: ROI. 1.2 Factors contributing productivity Improvement. 1.3 Productivity of material, land building. 1.4 Techniques for productivity measurement:- • Work content and ineffective time, • improving productivity by reducing work content, • improving productivity by reducing ineffective time, • Role of management, supervisor, worker in work study. 1.5 Simple productivity calculations based on actual production and standard production.
Unit-II Plant layout and material handling equipment's	2a.Explain various types of plant layouts with their merits, demerits and their application. 2b. Describe importance and applications of material handling equipment. 2c. Select material handling equipment's for given situation.	2.1 Plant layout: Definition and concept. 2.2 Types of plant layout, their applications, advantages and limitations. 2.3 Role of material handling systems in industries. 2.4 Classificationof Material handling equipment in Mechanical Industry, its applications and selection criteria.
Unit -III	3a. Apply the work study	3.1Influence of working conditions

Methods Study	procedure for a given manufacturing process. 3b.Draw Flow Process chart ,travel chart for given production shop 3c.Apply principles of motion economy	• Occupational safety • Fire prevention • Layout and house keeping • Lighting & ventilation • Noise and vibrations. 3.2 procedure of method study, 3.3 process chart symbols, 3.4 flow process chart, travel chart, Multiple activity chart, Two handed process chart 3.5String diagram. 3.6 Questioning technique 3.7 Primary questions & secondary questions. 3.8 Principles of motion economy, 3.9 use of human body , 3.10 arrangement of work place , 3.11 Introduction to 5s , 3.12 SIMO chart, 3.13 Therbligs, 3.14 Memo & Micro motion study.
Unit -IV Work Measurement	4a Record time for the element of work using time study equipment's. 4b Conduct a Time study for a given element of work.	4.1 Purpose & Procedure 4.2 Selecting the job & worker for the study. 4.3 Techniques of work measurement • Work sampling, • Stops watch Method. Time study: Definition, Objectives Time study equipment- stop watch, time study board, time study forms. • PTS • Standard data. 4.4 Standard Rating and performance. 4.5 Allowances. 4.6 Calculation of basic time and observe time
Unit -V Recent Trends in Production Engineering	5a. Describe recent trend in Production Engineering	5.1 International Organization for standardization and its role, ISO standard series and quality managements system. 5.2 Concept of six sigma and its applications. 5.3 Definition, objectives and applications of ergonomics. 5.4 Environmental requirements of work place 5.5 Concept and introductory information of • Just In Time

		• Kaizen • ERP • TPM

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Unit Name	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Productivity	11	2	6	4	12
2	Plant layout and material handling equipment's	8	4	4	4	12
3	Methods Study	11	4	12	8	24
4	Work Measurement	10	6	10	6	22
5	Recent Trends in Production Engineering	8	4	4	2	10
	Total	**48**	**20**	**36**	**24**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

7.LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

SrNo.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
1	I,V	• Survey/Data Collection and Data interpretation. a. Productivity & standard of living b. Productivity and GDP Comparison with other countries. c. ERP and its significance in an industrial concern.	4
2	I,III	• Case study -I a. National Productivity Council study of working of the organization. b. Production Layout of a small, medium and large industry.(take one actual example from each).draw sketches and give description c. Ideal workplace in reference to safety, layout, lighting etc.	4

3	V	• Case study -II a. Ergonomically designed workplace b. ISO standard series and quality managements system in any manufacturing industry (take one actual example) c. JIT/KAIZEN/TPM Practices in any industry. d. Listing non productive activities time at a workplace.	4
4	IV	• Time study: Calculate standard time for a given job using decimal minute stop watch techniques. Teacher will assign the situation/job/elements to be recorded. This include: a. Sketch the part undertaken for time study. b. List elements to be considered. c. Observe and record elements time. d. List and justify allowances to be taken with values. e. Calculate standard time.	6
5	IV	• Performance rating: Calculate co-efficient of co-relation for time study person using performance rating technique. Teacher will assign the situation. This include: a. Define performance rating. b. Describe the situation assigned by the teacher. c. List the steps followed to perform the exercise. d. Observe and record the observations. e. Plot, interpret and calculate the co-efficient of correlation.	4
6	III	Mini Project on following-(Any two) a. Sketch part and assembly, prepare OPC/flow process chart/Man machine chart, Prepare process planning sheet. b. To design a workplace using principle of motion economy c To conduct a methods study. d To conduct a time study using PTS/Standard Data/work sampling..	4
7	All units	• Visit at least two related industries. Prepare the report as per the guidelines provided by the teacher.	6
TOTAL			**32**

8. SUGGESTED STUDENT ACTIVITIES

Sr. No	Activities (ANY 8 to 10)
1	Search different journals on productivity
2	Collect information of NPC.
3	Watch The Web Site Of Niite Mumbai
4	List down what can be done from student side to improve the productivity in class room9(effective utilization of college time)
5	Draw the plant layout of workshop
6	Classify the raw material in the workshop as per IS Code
7	Draw the flow process chart for turning work piece
8	Prepare travel chart for supervisor in shop floor.
9	Apply 5 s to your study table.
10	Prepare CHART FOR THERBLIGS
11	Collect format for time study sheet.
12	Suggest any KAIZEN to improve manufacturing process in shop
13	Draw a multi-activity chart for supervisor operator two CNCs at a time for a given setup and cycle time.
14	Draw a string diagram for any operation in the shop.
15	suggest the simple jig and draw a sketch for drilling machine.
16	Prepare a group of 5 students and jot down the outcome of tossing the coin and plot normal distribution.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Sr no	Unit no	Unit name	Strategy
1	1	Productivity	Net survey, Movie on productivity
2	2	Methods Study	Live explanation, movie, case study
3	3	Work Measurement	Live explanation, movie, case study
4	4	Plant layout and material handling equipment's	Case study, survey, industrial visits
5	5	Modern Trends in Production Engineering	Net survey, Case study, industrial visits

10. SUGGESTED LEARNING RESOURCES

Sr No.	Title of Book	Author	Publication
1.	Industrial Engineering (IE) and Management	C.Natha Muni Reddy	New age international Publishers
2.	Introduction to Work-study	ILO	Oxford publication
3.	Tool Design	Donaldson	Tata MCGraw Hill Publication Company limited
4.	Handbook of IE: Technology and operations management.	GavrielSalvendy	Institute of Industrial Engineers.
5.	Comprehensive Industrial Engineering.	M. J Manek	Laxmi Publications (P) Ltd., New Delhi.
6	Introduction to Work-study. ISBN: 9221071081	George Kanawaty	International Labor Organisatioin, Geneva.
7	Introduction to productivity	---	National Productivity Council (NPC).
8	Method Study	---	NPC.

11. **Major Equipment/ Instrument with Broad Specifications**

Sr.No.	Major equipment/ Instrument with Broad Specification	Quantity
1	Decimal stopwatch (Non fly back type).	02 pcs.
2	Decimal stopwatch (Fly back type)	02 pcs.
3	Playing cards	2 sets.
4	M.S Pins 10mm dia X 15mm length with tolerance of ± 0.01mm.	100 pcs.
5	Buttons of 6 different colors.	100 of each color.

12LEARNING WEBSITE & SOFTWARE

a https://www.nptel.ac.in/courses
b https://www.k12reader.com
c https://www.eduaction.com
d https://www.k5learning.com

13.MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)WITH COURSE OUTCOMES (COs)

Sr No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Apply productivity improvement tools at all levels of workplace by using principles of industrial engineering	2	2	2	2	2	1	1	3	2	2	2	-
2	Analyze different types of plant layout & material handling equipments	2	2	2	2	1	1	-	-	-	2	2	1
3	Conduct a time study and Method study to establish the improved methods of doing a work.	2	2	**2**	2	1	1	1	2	2	2	2	2
4	Calculate Standard and basic time by using PTS	2	2	-	2	-	-	1	2	2	1	1	1
5	Comment the emerging trends in Production Engineering	1	3	2	2	1	-	-	-	2	1	-	-

Course Curriculum Design Committee

SrNo	Name of the faculty members	Designation and Institute
1	A.B Deshpande	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad
2	A.H.Chaudhari	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ADVANCED MANUFACTURING PROCESSES**

COURSE CODE **6M408**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Sixth

1. RATIONALE

Technicians engaged in engineering production should be competent in the selection and use of the machining processes, machines and tools. Today so many production processes and machines of advanced nature have been developed that it is really a problem to select a right machine and manufacturing process for a particular applications. The diploma technician should get the basic details of the machines used in the engineering practice. A good understanding of these machines will lead to better visualization of the practical problems encountered on the production shop floor. Automation has been playing an important role in the engineering applications. Present course will help the students to get fundamentals of the machines and various machining processes, process planning, cost evaluation of product and maintenance of machines.

2. COMPETENCY

At the end of studying this course students will be able to

"Produce components using various types of manufacturing processes."

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
3	-	4	7	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**;** PT – Progressive Test, PA- Progressive Assessment, OR – Oral Examination, TW - Term Work,# External, @ Internal examination,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Analyze operation of milling & gear production machines.
2. Interpret grinding machine operation.
3. Appraise surface finishing processes
4. Evaluate various non conventional machining processes
5. Select relevant SPM to produce quality job.
6. Produce jobs using milling, gear production, grinding & non conventional machines.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit- I Milling Machines :	1a) Explain constructional details and specification of given milling machines. 1b) Select suitable milling cutter for specific operation of a given job 1c) Compute milling time for a given job 1d) Identify nomenclature of a standard milling cutter.	1.1 Introduction, classification, Machine specifications, 1.2 Basic parts of column and knee type milling machine, and their functions, 1.3 Standard milling cutters, milling operations like plain milling, side milling, straddle milling, gang milling, face milling, slot milling, end milling, slitting. 1.4 Up milling and down milling, 1.5 Cutting parameters and machining time calculations (Simple Numerical).
Unit– II Gear Production Machines	2a. Select appropriate indexing method of gear cutting. 2b. Recommend gear generating method for specific gear.	2.1 Introduction. 2.2 Gear manufacturing methods, universal dividing head and indexing methods. 2.3 Gear generating methods like gear shaping and hobbing (setup, working, advantages, disadvantages and applications). 2.4Gear finishing methods-grinding, shaving, burnishing.
Unit III Grinding Machines	3a.Write specifications of grinding wheel. 3b.Significance of the grinding wheel balancing. 3c.Choose appropriate grinding	3.1 Introduction, classification, 3.2 Working of grinding machine 3.3 Types of Grinding process 3.4 Grinding wheel specifications, grinding wheel dressing and truing, selection criteria for grinding wheel, balancing of grinding wheels,

	wheel.	3.5 Safety precautions.
Unit– IV Surface Finishing	4a.Select surface finishing method for the given job. 4b.Select lapping parameters for the given job. 4c.State the significance of Polishing, buffing and burnishing	4.1Introduction, need of surface finishing, methods of surface finishing. 4.2 Working principles, merits, demerits and applications of Lapping, honing, super finishing, 4.3 Polishing, buffing and burnishing.
Unit – V Non conventional Machining Processes	5a. State the need and importance of non-conventional machining processes. 5b.Explain working principle of given conventional machining processes. 5c.Identify different non-conventional machining processes to be performed for the given job. 5d.Select process parameters for the given non-conventional machining processes.	5.1 Need, importance and classification of non-conventional machining, 5.2 working principles, 5.3 process parameters, 5.4 advantages, disadvantages and applications of following: • Water jet Machining (WJM) • Abrasive jet Machining (AJM) • Electro discharge machining (EDM) • Wire cut discharge machining (WEDM) • Laser beam machining (LBM) • Ultrasonic machining (USM) • Plasma arc machining.(PAM)
Unit – VI Automatic machines And Additive manufacturing	6a. Select appropriate automat for the given job. 6b. Significance of transfer line machines. 6c. Select suitable special purpose machine for the given job. 6d. Select appropriate additive process.	Automatic machines and Additive manufacturing(rapid prototype) 6.1 Introduction to automatic machines, classification, automation strategies, 6.2 Semiautomatic machines, multi tool center lathe, machining centers, SPM, transfer machining and its advantages, 6.3 Introduction of additive manufacturing, Types, advantages and disadvantage.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Milling Machines	08	2	6	4	12
II	Gear Production Machines	08	2	6	4	12
III	Grinding Machines	08	4	6	4	14
IV	Surface Finishing	08	4	6	4	14
V	Non conventional Machining Processes.	08	4	8	4	16
VI	Automatic machines and Additive manufacturing(rapid prototype)	08	2	6	4	12
		48	**18**	**38**	**24**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Gear Cutting – One job involving boring, gear cutting and keyway cutting.	14
2	II	Prepare a job containing surface grinding / cylindrical grinding operations as per given drawing. 1.Facing, turning and centre drilling Grinding (Cylindrical)	18
3	III ,IV	Prepare a job on lapping machine as per given drawing. • Demonstration on the lapping machine setup. • Prepare job on lapping machine as per the given drawing. OR Prepare a job on honing machine as per given drawing. • Demonstration on the honing machine setup.	16

		• Prepare job on honing machine as per the given drawing.	
4	V	Prepare a job on any SPM (Turret/Capstan Lathe, Automat) as per given drawing. a) Prepare a job on Turret/Capstan Lathe consist of the operations facing, plain/step turning, drilling as per given drawing. b) Prepare a job on Automat consist of the operations turning, threading, parting-off as per given drawing.	16
Total			**64**

8. SUGGESTED STUDENTS ACTIVITIES

1. Prepare journal for practicals.
2. Visit to concerned industries.
3. Write specifications of different machine tools observed during industrial visit.
4. Library/ Internet survey related to advanced machining processes and prepare a report.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Title of Book	Author	Publication
1	Workshop Technology Vol. 2	Hajra, Choudhary	Asia Publications Delhi
2	Workshop Technology Vol.2	Raghuwanshi,	Dhanpat rai and sons
3	Production Technology	R.K. Jain,	Khanna Publications
4	Workshop Technology	Chapman (Vol. 1 & Vol. 2) ,	Arnold Publications

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED

Sr. No.	Name of equipment	Brief specification
1.	Centre lathe, with required set of work holding devices, cutting tools, accessories and tool holders. Cutting tools to include carbide inserts and related tool holders for carbide inserts.	As per the specifications
2.	Horizontal milling machine, with required set of work holding devices, cutting tools, accessories and tool holders. Cutting tools to include carbide inserts and related tool holders for carbide inserts. Should also include indexing head.	As per the specifications
4	Drilling, with required set of work holding devices, cutting tools, accessories and tool holders.	As per the specifications
5	Tool and cutter grinding machine, with required set of work holding devices, cutting tools, accessories and tool holders.	As per the specifications
6	Cylindrical grinding machine, with required set of work holding devices, cutting tools, accessories and tool holders. vi. Or Surface grinding machine.	As per the specifications
7	Lapping & Honing machine.	As per the specifications

12. LEARNING WEBSITE & SOFTWARE

i. NPTEL Lecture Series.

ii. http://www.intel.com/pressroom/kits/quickreffam.htm

iii. web.stanford.edu/class/ee282

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Analyze operation of milling & gear production machines.	2	2	3	2	-	1	-	-	-	1	-	2
2	Interpret grinding machine operation.	2	2	2	1	1	-	-	-	-	1	1	2
3	Appraise surface finishing processes	2	2	2	3	-	1	-	-	1	2	1	2
4	Evaluate various non conventional machining processes	3	3	3	2	1	1	-	-	1	2	2	3
5	Select relevant SPM to produce quality job.	1	3	3	2	1	1	-	-	-	2	1	3
6	Produce jobs using milling, gear production, grinding & non conventional machines.	2	2	3	2	1	1	-	1	1	2	2	3

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Dr.U.V Pise	Head of the Department, Govt. Polytechnic, Aurangabad
2	D.V Tammewar	Workshop Superintendent , Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **PROJECT**

COURSE CODE **6M502**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
CE/ME/EE/EJ/CO/IT/AE/DDGM	Sixth

1. RATIONALE

One of the basic aim of "Project " is to develop the ability of "learning to Learn " on his own and work in team .Project course provides opportunities for students to keep pace with future changes in technology and in the acquisition of knowledge and skills as and when needed. The course of the "Project" is designed with an aim to all these requirements of the students, which will include planning of the Programme, which must be completed within the time allocated. The Project should never have a single solution and process of arriving at a particular solution, the student must be required to make number of decisions after study information as he has gathered from experiments, surveys, analysis etc.

The programme aims at developing in the student, knowledge and skills to match the current and projected needs of industry/ user systems, social awareness and professional attitudes. In relation to the course and topics to be taught, the student will have to constantly update himself and keep pace with the changing technologies and the current and projected needs of user systems. Another important aspect is the development of the attitude of enquiry, the inculcation of sound study and work habits, side by side with the development of the overall personality as well as positive attitudes

Apart from supervising the engineering processes and maintenance of Engineering work ,machines and equipment's , a diploma technician has to do investigate, survey, collect data, refer handbooks and design some components , prepare estimates. Thus it will be observed that the job of a Mechanical engineer is of integrating knowledge of different theoretical subjects in successful completion of an engineering work.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different

types of skills so that students are able to acquire following competency.

"Apply the knowledge of various courses to solve real life problems of society and to develop team work, leadership and entrepreneurship skills to make students professionally competent

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
-	-	4	4	--	--	50#	100	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Conduct Surveys/ Investigate the field situation , collect, analyze and synthesize the data
2. Apply Knowledge to solve field Problems
3. Develop of inquisitive ,innovative skill and confidence to work independently
4. Participate effectively in group work
5. Conduct required experiment/testing
6. Prepare and present the project report.

5. DETAILED COURSE CONTENTS

Sr. No.	Unit	Project work activities	Hours
1.	1	Literature survey, data collection, identifying problem, deciding scope of topic and objective of the project, discussion, topic selection.	12
2.	2	Searching of information, analyzing, Interpretation, editing of information of collected data, procurement of material for experimentation if required.	12
3	3.	Experimentation, testing, calculations, data survey, Solutions to given problem / work if any	12

4.	4	Design, calculations, costing and programming wherever necessary finding Conclusions.	12
5.	5	Preparation of Model/chart/video shoot/ppt etc.	08
6.	6	Report writing, editing, Presentation and submission	08
Total			**64**

6. SUGGESTED STUDENT ACTIVITIES

a) Form the group of 4/5 student for a project activity.

b) Allot the guide (faculty) for each group.

c) Decide the topic of project.

d) Conduct survey/experimentation.

e) Report writing and presentation.

7. SUGGESTED AREAS FOR THE PROJECT WORK.

Sr. No.	Areas For Selection
1	Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/demonstration models etc. Report involving aspects of drawing, process sheets, costing, Installation, commissioning & testing should be prepared and submitted.
2	Design & fabrication of mechanisms, machines, Devices etc.
3	Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots etc.
4	Industry sponsored projects-project related with solving the problems identified by industry should be selected. One person / engineer from industry is expected to work as co-guide along with guide from institution.
5	Topic selected must be related with latest technological developments in mechanical or Mechatronics field and should not be a part of diploma curriculum.
6	Investigative projects-Project related with investigations of causes for change in Performance or structure of machine or component under different constraints through

	experimentation and data analysis.
7	Maintenance based projects: The institute may have some machine/ equipment/ system which are lying idle due to lack of maintenance. Students may select the specific machines/equipment/system. Overhaul it, repair it and bring it to working condition. The systematic procedure for maintenance to be followed and the report of the activity are submitted.
8	Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement, data collection, data analysis and data interpretation be undertaken.
9	Low cost automation projects: Project based on hydraulic/pneumatic circuits resulting into low cost automated equipment useful in the identified areas.
10	Innovative/ Creative projects-Projects related with design, develop & implementation of new concept for some identified useful activity using PLC, robotics, non-conventional energy sources, CIM, Mechatronics etc.
11	Environmental management systems projects: Projects related with pollution control, Solid waste management, liquid waste management, Industrial hygiene etc., Working model or case study should be undertaken.
12	Market research/ survey based projects: Projected related with identification of extent of demand, sales forecasting, comparative study of marketing strategies, comparative study of channels of distribution, Impact of variables on sales volume etc.

8. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

a) The project topic/ title should not repeated by group.
b) Guide should be Senior or experienced faculty
c) The project topic should selected such that, it should complete in a semester.

MAJOR PROJECT REPORT FORMAT

a. Project report shall be in the print form on A-4 size white bond paper.
b. Typing shall be in Times New Roman with spacing of 1.5 using one side of paper.
c. Margins: Left = 37.5 mm Right, Top and Bottom = 25mm.
d. Front page: Titles - TNR 18 bold, other – TNR 14 bold. With Institute Logo.
e. Inner Pages: Titles –TNR – 14 Bold , other TNR 12 .

f. Page Nos: Should appear on the right hand top corner of each page starting after index page.

g. Tables to be preferable in the Text format only.

h. Sketches to be drawn on separate sheet / pages in black ink.

i. The Last content in the index to be of references. Acknowledgement to be added in the report.

j. Binding: Hard with golden embossing on the front cover of black colour is preferred for the Major Project report. The number of copies are to be prepared by the student are 7 nos.
(If, 5 Student + Guide +Department Copy)

9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Hand book of Print Media	---------	----------
2	IS code	---------	----------
3	Reference books as per selected areas	---------	----------

10. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	No. of hours
CO1	Conduct Surveys/ Investigate the field situation , collect, analyze and synthesize the data	1	2	-	2	-	-	-	2	2	-	1	-	12
CO2	Apply Knowledge to solve field Problems	2	3	2	2	1	1	-	1		1	1	2	12
CO3	Develop of inquisitive ,innovative skill and confidence to work independently	1	1	2	2	-	-	-	-	-	3	1	1	12
CO4	Participate effectively in group work	-	-	-	-	-	-	1	3	2	-	-	2	12
CO5	Conduct required experiment/testing	-	-	3	2	-	-		3	2	-	1	3	08
CO6	Prepare and present the project report.		2	-	-	-	-	-	3	2	-	2	-	08

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	Prof. J.S. Patil	HOD Civil Engg , Govt. Polytechnic, Aurangabad
2	Prof. Y.M.Patil	Sr. Lecturer in Civil Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ADVANCED MANUFACTURING SYSTEMS**

COURSE CODE **6M507**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Sixth

1. RATIONALE

In the present scenario of globalization, liberalization and privatization, manufacturers have to be very competitive. To be competitive, companies should attempt to be best in the field of quality, price, delivery speed, delivery reliability, flexibility and innovation. Organizations should therefore aim to maximize performance in these areas in order to maximize competitiveness. In this view it is important for the Diploma Engineers to understand fundamental concepts, principles and applications of advanced manufacturing systems which enable him to work as an engineer in competitive industrial environment.

2. COMPETENCY

At the end of studying this course students will be able to -

"To apply the tools and techniques of manufacturing throughout the supply chain for productivity improvement, quality improvement, cost reduction and waste elimination"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
04	0	02	06	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-**Credits**; ESE-** End Semester Examination**; PT –** Progressive Test**, PA-** Progressive

Assessment, OR – Oral Examination, **TW - Term Work**, # External examination , @ Internal.~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Compare world class manufacturing with conventional manufacturing.
2. Use tools of Lean Production for waste elimination.
3. Apply tools of JIT system for minimize inventory.
4. Identify the losses affecting overall equipment effectiveness.
5. Apply the principles of TQM for quality improvement and cost reduction.
6. Suggest the locations for improvement in workplace using 5S principles.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit –I Introduction to World class manufacturing System.	1a. Identify needs of world class manufacturing. 1b. Compare mass production with WCM 1c. Write best industrial inventory control practices. 1d. Suggest type of plant layout in a given situation	1.1. Definition of WCM 1.2. Need of WCM 1.3. Critical Success factors of WCM 1.4. Mass production and its comparison with WCM 1.5. Inventory in mass production. 1.6. Modern industrial inventory control practices 1.7. Plant layout-objectives and types
Unit– II Lean Manufacturing	2a. Write the steps in Lean manufacturing 2b. State the key principles in lean system 2c. Identify different types of wastes. 2d. Develop a value stream map for a given set of operation.	2.1 Concept of Lean manufacturing 2.2 Steps for implementing the lean manufacturing system. 2.3 Key principles of Lean system 2.4 Types of waste, identification of waste and 3M 2.5 Value stream mapping 2.6 Benefits of lean manufacturing

Unit– III Just in Time Manufacturing	3a. Enlist the need for JIT. 3b. Develop a Kanban for different situations 3c. Compare push and pull manufacturing 3d. Identify the situations where cellular manufacturing is required	3.1 Introduction JIT. 3.2 Objectives and elements of JIT 3.3 Industrial Examples of JIT 3.4Kanban system and its types 3.5 Single piece flow of material 3.6 Pull and Push manufacturing 3.7 Cellular manufacturing.
Unit– IV Total Productive Maintenance	4a. State the measures of TPM 4b. Give the equation for OEE and state meaning of each parameter in it. 4c. State eight pillars of TPM and effects on OEE	4.1TPM- definition, necessity 4.2 objectives and measures of TPM 4.3 Overall Equipment Effectiveness 4.4 Six Big losses 4.5 Steps in implementing TPM 4.6 Eight pillars of TPM 4.7 Tangible and intangible Benefits of TPM
Unit - V Total Quality Management	5a. Enlist the necessity of TQM. 5b. Compare TQM with ISO. 5c. Discuss the benefits of TQM	5.1 TQM- Definition, Fundamentals 5.2 Principles of TQM 5.3 Objectives of TQM 5.4 Comparison of ISO & TQM 5.5 Benefits of TQM
Unit – VI Various tools of Lean Manufacturing	6a. State necessity of Workplace mgt. 6b. Develop a Kaizen for a given problem 6c. Develop a Poka-Yoke for a given situation. 6d. Calculate time saving in SMED for a given situation.	6.1 Workplace organization 6.2 Necessity and principles of 5 S 6.3 Concept of kaizen with industrial applications. 6.4 POKA-YOKE- Definition, types 6.5 Identification and development of Poka- yoke techniques 6.6 Concept of SMED with industrial example

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Introduction to World class manufacturing System**.**	10	02	06	04	12
II	Lean Manufacturing	10	02	10	06	18
III	Just in Time manufacturing	12	04	10	06	20
IV	Total Productive Maintenance	10	02	04	02	08
V	Total Quality Management	08	00	04	02	06
VI	Various tools of Lean manufacturing	14	02	10	04	16
	Total	**64**	**12**	**44**	**24**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	Application of various WCM tools and techniques in a World Class Manufacturing organization and enlist their benefits.	04
2	II	Apply the lean manufacturing principles and develop a value stream map for a given production line.	04
3	III	Application of JIT philosophy for two given industrial situations.	04
4	III	Design and application of KANBAN system for two given industrial situations.	02
5	III	Application of group technology and design of cellular layout for two given conventional layouts.	04
6	IV	Apply the TPM policy of any two companies to study six big	04

		losses and overall equipment effectiveness.	
7	V	Application of TQM principles and its comparison with ISO 9000 for given WCM organization.	04
8	VI	Application of 5'S' principles for workplace management of two given industrial situations and enlist their benefits.	04
9	VI	Design and application of a Poka-Yoke for a given industrial situation and enlist the benefits.	02
		Total	**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1. Prepare journals based on practical's performed in laboratory.
2. Make a list of world class manufacturing companies through internet search.
3. Visit any two industries applying lean techniques to eliminate waste and prepare a report.
4. List any five companies using JIT philosophy and write about the results JIT implementation.
5. Collect samples of KANBAN card from industries.
6. Collect for TPM philosophy of any two industries on internet or by visiting industry.
7. Write the details of ISO certified companies which use TQM and ISO standards.
8. Make charts of 5 'S' used in any small scale industry.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Demonstration
c. Seminars and industrial visits
d. Activity based learning.
e. Q & A technique.

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	World Class Manufacturing	Richard j. Schonberger,	The Free Press,1996.
2	Just- in Time Manufacturing	Korgaonkar M.G.,	Macmillan India ltd.,1992
3	Automation, Production Systems & Computer Integrated Manufacturing	Mikell P. Groover,	Pearson Education, Inc., 2001
4	Lean Thinking.	James Womack And Danial Jones,	Free Press Revised Edition 2003
5	Lean Production Simplified	Pascal L Dennis,	Productivity Press, 2007

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Charts for WCM, Plant layout, Lean manufacturing, KANBAN	Standard size
2.	Industrial reports/manuals for TPM,TQM,ISO,5's,POKA-YOKE	As per industrial norms.
3.	Standard available software's for above course content.	As per the content.

12. LEARNING WEBSITE & SOFTWARE

a http://www.managementstudyguide.com/world-class-manufacturing.htm

b http://www.plantengineering.com/single-article/10-steps-to-achieve-world-class-manufacturing-maintenance-practices/ddf17ae1b221218faae1406727eecf62.html

c http://www.abhinavjournal.com/images/Commerce_&_Management/Aug12/15.pdf

d http://www.wcmconsulting.in/Articles/World%20Class%20Manufacturing_English.pdf

e http://www.gobiztech.com/docs/Infor-Seven-Keys-World-Class-Manufacturing.pdf

f http://leanmanufacturingtools.org/39/lean-thinking-lean-principles/

g http://www.processexcellencenetwork.com/lean-six-sigma-business-transformation/articles/12-essential-lean-concepts-and-tools

h http://www.toyota-global.com/company/vision_philosophy/toyota_production_system/just-in-time.html

i http://www.leanproduction.com/tpm.html

j http://www.plant-maintenance.com/articles/tpm_intro.shtml

k http://asq.org/learn-about-quality/total-quality-management/overview/overview.html

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

S. No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Compare world class manufacturing with conventional manufacturing.	03	03	-	-	03	-	-	-	-	-	03	-
2	Use tools of Lean Production for waste elimination.	-	03	-	-	03	-	-	-	-	-	-	03
3	Apply tools of JIT system for minimize inventory.	-	03	-	-	-	-	-	-	03		03	03
4	Identify the losses affecting overall equipment effectiveness.	-	03	-	03	-	-	-	-	-	-	-	03
5	Apply the principles of TQM for quality improvement and cost reduction.	-	03	-	-	03	03	-	-	03	-	-	-
6	Suggest the locations for improvement in workplace using 5S principles.	-	03	-	03	-	-	-	-	-	-	03	03

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S. B. Kulkarni	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	V. M. Bukka	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **ALTERNATE ENERGY SOURCES**

COURSE CODE **6M508**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Sixth

1. RATIONALE

Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population and enhanced standard of living and life style of people. In future time nearly all the conventional energy sources will be replaced by alternate energy sources all over the globe. Solar and Wind energies play an important role in alternate energy sources. Recently significant advances are made in utilization of solar energy in heating and electrical energy conversion applications. Biomass and bio fuels are also getting importance. Alternative fuels such as Biodiesel, Ethanol are used in practice. Technicians are required to develop, operate and maintain these systems in coming future.

2. COMPETENCY

At the end of studying this course students will be able to

"Practice the use of green energy for better future"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T**-Tutorial/Teacher Guided Theory Practice **; PA-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, **@** Internal,**~** Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Use alternate energy conversion systems in daily practice.
2. Identify various energy wastage locations.
3. List energy conservation techniques.
4. Conduct preliminary energy audit of an installation.
5. List various Energy reuse and regeneration methods.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit - I Introduction to Energy sources	1a.Classify various types of energy sources 1b.Locate energy crisis situations 1c.Identify needs of Alternate Energy Sources	1.1 Introduction to energy and its use. Classification of energy sources such as conventional, Nonconventional, Renewable, Non renewable, Primary, Secondary, Commercial and Non Commercial sources. Short introduction to Geothermal, Tidal energy. 1.2 Energy Crisis and remedies. 1.3 Energy scenario in World and in India 1.4 Need of development of Alternate energy sources

Unit - II Solar Energy and applications	2a.Write concepts of solar energy conversion into heat and electricity. 2b.Develop different solar list advantages and disadvantages of solar systems 2c.Compare different solar systems 2d.Locate areas of applications of solar energy.	2.1 Principle of conversion of solar energy into heat and electricity, solar radiation. Solar radiation's at earth's surface. Solar radiation geometry-declination, hour Angle, altitude angle, incident angle, zenith angle, solar azimuth angle. Solar radiation measurement, pyrheliometers, pyranometer **Applications of Solar energy-** 2.2 Classification, construction and working and applications of typical Flat plate collectors, Solar concentrating collectors and their applications, advantages and limitations. 2.3 Space heating and cooling Systems their classification, working and applications. Domestic solar heaters their types and applications. 2.4 Photovoltaic electric conversion systems, their classification, working and applications. Direct solar electric conversion systems(Roof top systems) 2.5 Solar distillation, Solar cooking and furnace, Solar pumping and Green house, Agriculture and industrial process heat. (No numerical, no derivations.)
Unit - III Wind Energy & Applications	3a.Write concepts of wind energy conversion. 3b.Demonstrate working of different wind electric systems 3c.List advantages and disadvantages of wind electric conversion systems 3d.Compare different wind mills/aero generators for	3.1 Introduction, Basic principles of wind energy conversion, power in wind, derivation of available wind power formula, power coefficient, maximum power. Main considerations In selecting a site for wind mills, advantages and limitations of wind energy Conversion, wind energy data 3.2 Basic Wind Energy Conversion System (WECS) yaw control, pitch control,

	performance 3e.Locate areas of applications of wind energy conversion systems	components, construction and working of horizontal axis wind electric conversion system. 3.3 Classification of wind mills/aero generator, construction and working of horizontal And vertical axis wind mills, their comparison, Savonious and Darrius type vertical axis wind mills their construction, working, comparison and applications. Performance of wind machines 3.4 Main schemes of wind energy for power generation systems, wind pumping systems.
Unit - IV Energy From Biomass	4.a Write principles biomass energy conversion processes 4.b Compare biomass energy conversion processes 4.c Write applications of different Gasifies 4.d Write process of manufacturing of biofuels. 4.e Compare various compare various biofuels.	4.1 Common species recommended for biomass, 4.2 Methods for obtaining energy from biomass (Biomass conversion) such as Direct Combustion, Thermo chemical conversion and Biochemical conversion. 4.3 Thermal gasification of biomass-gasifiers, Types of gasifiers such as up draught. Downdraught and cross draught fixed bed and fluidized bed gasifiers , application of gasifiers 4.4 Anaerobic Digestion and fermentation of biomass, biomass digesters, Biomass digester classification and types Agricultural waste as biomass, comparison of biomass with conventional fuels. Biodiesel production and applications Ethanol production and applications.
Unit - V Energy	5a. Write energy conservation on global and national	5.1 Energy conservation and management, global and Indian energy market,

Conservation	basis. 5b. Identify various factors affecting energy conservation 5c. Locate various parameters/factors leading to energy wastage.	energy scenario in various sectors and Indian economy 5.2 Need and importance of energy conservation and management, 5.3 concept of payback period, return on investment(ROI), life cycle cost, 5.4 Sankey diagrams, specific energy consumption. their applications in industries
Unit – VI Energy Conservation Techniques	6a. Able understand energy distribution and energy conservation 6b. Understand concept of energy audit 6c. Appreciate role of energy management in energy conservation. 6d. Identify areas where energy audit is required. 6e. Locate the areas of energy waste and energy reuse.	6.1 Distribution of energy consumption, principle of energy conservation, 6.2 Energy audit, types of audits, method of conducting energy audit, Advantages of energy audit Methods of energy conservation. 6.3 Cogeneration and its application, combined cycle system, their advantages, disadvantages and applications. 6.4 Concept of energy management, study of different energy. Management techniques like- analysis of input, reuse and recycling of waste, energy education, conservative technique and energy audit.
Unit –VII Economics of Energy Conservation	7a Identify parameters costing various utilities. 7b Estimate costs of utilities. 7c Identify factors improving efficiency of devices and systems. 7d Substitute conventional system with waste heat recovery systems. 7e Apply energy conservation principles in various systems.	7.1 Costing of utilities like steam, compressed air, Electricity and water used in industries. 7.2 Ways of improving boiler efficiency, Thermal insulation, Critical Thickness of insulation, waste heat recovery systems like exchangers, Regenerators, wheels, Heat Pipes, their applications. 7.3 Introductory approach of energy conservation in compressed air, refrigeration systems, Air-conditioning systems, Pumps, Fans.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
1	Introduction to Energy sources	5	2	3	2	7
2	Solar Energy and applications	14	4	9	6	19
3	Wind Energy & Applications	14	4	9	6	19
4	Energy From Biomass	9	3	3	4	10
5	Energy Conservation	7	2	2	3	7
6	Energy Conservation Techniques	8	3	4	3	10
7	Economics of Energy Conservation	7	2	4	2	8
	TOTAL	**64**	**20**	**34**	**26**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS (Any 10)

Sr. No	Unit No	Practical Exercises	Approx Hours Required
1	I,II	**Collection of technical literature/Specifications** Students should collect technical literature/specifications from reputed manufacturers and BIS specifications for following appliances/devices. Students should visit dealers and manufacturers as well as refer web sites of manufacturers and collect the same. • Flat plate collector (copper tube type) Solar water heating system (Along with Installation procedure) • Evacuated Tube Collector (EVT) type solar collector • House hold solar photovoltaic system (Battery backup type) • House hold Net metering Grid connected type direct solar system • Solar street lamp • Solar pumping systems • House hold box type solar cooker • Parabolic solar cooker • Solar distillation unit	02 Hrs
2	II	**Trial on Household Box type solar cooker** • The trial on house hold box type solar cooker shall include following aspects, • Study of box type cooker and record of construction and working with sketches. • Determination of cooking time for a.Rice b.Dal c.Noodles . d. Peanuts in morning time (9 am to 12 pm) and in afternoon time (2 pm to 5 pm) • Plotting graph of Cooking time Vs item • Determination of temperature in the box of cooker with probe type thermometer from 7am to 5 pm and plotting of graph of temperature Vs Time	04 Hrs.

3	II	**Trial on Household Parabolic type solar cooker** • The trial on house hold Parabollic type solar cooker shall include following aspects, Study of Parabolic type cooker and record of construction and working with sketches. • Determination of cooking time for a. Rice b. Dal c. Noodles . d. Peanuts in morning time (9 am to 12 pm) and in afternoon time (2 pm to 5 pm) • Plotting graph of Cooking time Vs item • Determination of temperature in the box of cooker with probe type thermometer from 7am to 5 pm and plotting of graph of temperature Vs Time.	04 Hrs
4	I,II	**Study and observation of operation of Roof top Direct solar energy converting system supplying electrical energy to appliances as well as to MSEB**. Here following steps should be followed, • Location of system. • Obtaining specification/ capacity of system with sketching layout of system along with noting the operational principle of system. • Observing operation of system and noting no. of units generated per day and per month, number of units consumed by customer and number of units given/sold to MSEB per day and per month. • Systematic record in file	02 Hrs
5	I,II	**Observation and trial on Flat Plate Collector Solar Water heating system** The trial on Flat Plate Collector Solar Water heating system shall include following aspects, • Study of Flat Plate Solar Water heating system and record of construction and working with sketches along with specifications. • Determination of Maximum temperature of water • Recording maintenance steps for Flat Plate Solar Water heating system	02 Hrs.

		• Listing advantages and Disadvantages of system.	
6	I,II	**Observation and trial on Evacuated Tube Collector Solar Water heating system** The trial on Evacuated Tube Collector Solar Water heating system shall include following aspects, • Study of Evacuated Tube Collector Solar Water heating system and record of construction and working with sketches along with specifications. • Determination of Maximum temperature of water • Recording maintenance steps for Evacuated Tube Collector Solar Water heating system • Listing advantages and Disadvantages of system	04 Hrs
7	I,II	Visit to plant of solar heating system for hotel/hostel/railway station etc.	02 Hrs
8	II	Study and observation of solar street lamp system	02 Hrs.
9	III	Visit to wind farm and observation of operation of Horizontal axis Aero generator type wind energy conversion system.	04Hrs
10	IV	To visit a biomass/ biogas plant of municipal waste or private owned.	04 Hr
11	V,VI	Perform energy audit for workshop/Office/Home/SSI unit.	04 Hr
12	VII	Study of various waste heat recovery devices like heat exchangers, regenerators, heat pipe practically in industry.	02 Hrs
13	II	Study of solar energy conversion systems like solar cars, solar boilers, Solar energy system of satellites, Solar railways etc	02 Hr

NOTE: Any TEN Practical's from above list.

a. It is compulsory to prepare a journal for exercises. It is also required to get each exercise recorded in journal, checked and duly dated signed by teacher.PA component of practical marks is dependent on continuous and timely evaluation of exercises.

b. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.

c. Mini project and presentation topic/area has to be assigned to the students in the beginning of the term by batch teacher.

d. Student activities are compulsory and are part of term work.

e. Term work content of industrial visit report should also include following.

i. Brief details of industry visited.

ii. Type, location, products, rough layout, human resource, etc of industry.

iii. Details, description and broad specifications of machineries/ processes observed.

iv. Safety norms and precautions observed.

v. Student's own observation on industrial environment, productivity concepts, quality consciousness and quality standards, cost effectiveness, culture and attitude.

vi. Any other details / observations asked by accompanying faculty.

8. SUGGESTED STUDENTS ACTIVITIES

Sr. No	Activities
1	Search different journals on solar energy, wind energy, biomass.
2	Collect info on specifications of solar and wind energy conversion systems
3	Collect information on special solar direct energy conversion systems
4	Assemble circuits/devices operating on solar energy in your laboratory.
5	Design Fabricate small solar cooker with different designs in laboratory.
6	Design Fabricate small wind aero generator with different designs in laboratory
7	Conduct energy audit of your class room and give suggestions to reduce energy wastage.
8	Design and implement energy conservation education program for your department

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

Sr. no	Unit no	Unit name	Strategy
1	I	Introduction to Energy sources	Class room instructions ,Net survey,
2	II	Solar Energy and applications	Class room instructions ,Net survey, Videos, field demonstrations

3	III	Wind Energy & Applications	Live explanation, movie, field demonstrations, visits
4	IV	Energy From Biomass	Class room instructions, Videos, PPT, Practical demonstrations, Industrial vists
5	V	Energy Conservation	Class room instructions ,Net survey, Case study, industrial visits
6	VI	Energy Conservation Techniques	Class room instructions ,Net survey, Case study, industrial visits

10. SUGGESTED LEARNING RESOURCE

Sr. no	Title of Book	Author	Publication
1	Non conventional energy resources	Dr B.H.Khan	Tata McGraw Hill
2	Non conventional energy Resources	. G. D. Rai	. Khanna publication
3	Solar energy	S. P. Sukhatme	Tata McGraw Hill
4	Solar energy	H. P. Garg	Tata Macgrawhill
5	Power plant engineering	Arora Domkundwar	Dhanpat Rai & co.
6	India- The energy sector	P.H. Henderson	Oxford University Press
7	Industrial energy conservation	D. A. Ray	Pergaman Press
8	Non-conventional energy source	K. M. Mittal	Khanna publications
9	Energy resource management	Krupal Singh Jogi	------

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr. No.	Major equipment/ Instrument with Broad Specification	Quantity
1	House hold box type cooker	01
2	Household parabolic cooker	01
3	Flat Plate Collector Solar Water heating system	01
4	Evacuated Tube Collector type water heating system	01
5	Digital temperature measuring device (Probe type)	01
6	Specimen Mounting Press	01
7	Working model of solar photovoltaic conversion system	01 set
8	Working model of solar street lamp	01

12. LEARNING WEBSITE & SOFTWARE

a. Website for Akshay Urja News Bulletin. (www.mnes.nic.in)
b. www.mnre.gov.in
c. mnre.gov.in/schemes/solar-rd-projects/v.
d. www.iisc.ernet.in/insa/ch34.pdf
e. www.ireda.gov.in/
f. www.zenman**energy**.org/
g. **wind**eis.anl.gov/guide/basics/
h. www.**suzlon**.com/

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

Sr.No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Use alternate energy conversion systems in daily practice.	3	2	2	2	1	1	-	-	2	2	1	2
2	Identify various energy wastage locations.	3	2	1	2	2	1	-	-	1	1	2	-
3	List energy conservation techniques.	2	2	-	1	-	2	-	-	2	2	3	-

4	Conduct preliminary energy audit of an installation.	1	3	-	3	-	-	1	1	1	1	2	2
5	List various Energy reuse and regeneration methods	3	2	-	1	-	1	1	-	1	2	3	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	S.P. Shiralkar	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	A.B. Deshpande	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **METROLOGY AND QUALITY CONTROL**

COURSE CODE **6M505**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Sixth

1. RATIONALE

The course Engineering Metrology and quality control makes the student to understand the process of measurement, the measuring instrument and its care and maintenance. The student should also understand the concept of quality control needed in any industry. Also the student should be able to use various measuring instruments, select the appropriate instrument for a particular application.

2. COMPETENCY

"Measure various parameters by using different measuring instruments"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (PR)	PA (TW)	150
3	-	2	5	80	20	25#	25	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; PR-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Select relevant measuring instruments for various industrial jobs.
2. Use a standard operating procedure for measurement and calibration.
3. Select proper chart for process capability study of a set of jobs from industry.
4. Set various measuring instruments for different jobs.

5. Analyze the data obtained from measurement for SQC.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit –I Fundamentals Of Metrology And Basics of Measurement.	1a. Differentiate between Accuracy and precision. 1b. Describe need for Inspection and calibration 1c. Justify selection of type of standard for particular measurement. 1d. Describe Linear measurement and Angular Measurement 1e. Explain working of different instruments for Linear measurement and Angular Measurement	1.1. Definition of metrology 1.2. Needs of inspection, 1.3. Common terminology used such as accuracy, precision, sensitivity, magnification errors, and sources of errors. 1.4. Concept of calibration. 1.5. Linear Measurement - Vernier Caliper, steel rule, Micrometer. 1.6. Line standard, end standard and wavelength standard 1.7. Angular measurement 1.8. Construction & working of bevel protractor, sine bar, angle gauges
Unit– II Limits, Fits & Gauges:	2a. Differentiate between Hole Basis System and Shaft Basis System. 2b. Apply the principle of Gauge Design to compute tolerance for different jobs 2c. Use different types of Gauges a given measurement	2.1 Basic terminology of limits and Fits. 2.2 Types of fits, hole basis System and shaft basis system of fits. 2.3 Types of gauges – Plug gauges, snap gauges, ring gauges and relation gauges. 2.4 Taylor's principle of gauge Design and Simple numerical on tolerance calculations.
Unit– III Comparators	3a. Select a Comparator for a given application. 3b. Compare various comparators	3.1 Principle of comparators 3.2 Operation of various comparators. 3.3 Characteristics of a good comparator, 3.4 Dial indicator as mechanical comparator, 3.5 Pneumatic comparator – Solex and high pressure dial type, Electric comparators, 3.6 Relative merits and demerits of various comparators.

Unit	Major Learning Outcomes (Cognitive Domain Only)	Topics And Sub-Topics
Unit– IV Screw Thread & Gear Measurement	4a. Identify different types of thread, various parameters and errors in threads. 4b. Use various instruments for measuring thread parameters. 4c. Identify various gear tooth elements. 4d. Use various instruments for measuring gear tooth parameters.	4.1 Terminology of screw thread, 4.2 Errors in threads, 4.3 Measurement of various parameters, of screw threads such as major diameter, minor diameter, effective diameter, pitch using instruments – screw thread micrometer, floating carriage micrometer, 4.4 Gear terminology, 4.5 Measurement of chordal thickness, addendum using gear tooth vernier, Parkinson gear tester,
Unit – V Surface Finish Measurement & Testing Techniques	5a. Describe Surface finish. 5b. Draw Symbol representing surface finish. 5c. Use of various instruments to measure surface finish. 5d. Draw a setup for alignment testing different types of machines.	5.1 Importance of surface finish and Terminology. 5.2 Symbol representing surface finish on drawing, 5.3 Principle & operation of stylus probe instrument 5.4 Tomlinson surface meter and Taylor-Hobson surface Talysurf. 5.5 Straightness testing by straight edge & autocollimator, 5.6 Flatness testing by optical flats, 5.7 Various cases of squareness testing, parallelism testing by using dial indicator, circularity testing (Roundness testing) using dial indicator. 5.8 Machine Tool Testing:- Alignment test to be carried out on lathe machine and drilling machine
Unit – VI Basic Concepts Of Quality And Introduction To SQC	6a. Describe Quality, quality control and quality assurance function. 6b. Use a statistical control technique for a given data 6c. Predict the capability of process for a given data by means different control chart. 6d. Apply a quality control tool for solving a industrial problem.	6.1 Definitions of quality, quality characteristics, 6.2 Need of quality control, quality of design, quality of performance, and quality of conformance. 6.3 Quality function cost of quality, value of quality, quality control. 6.4 Quality assurance – concept, quality mindedness, quality audit. 6.5 Quality circle – concept, purpose, function 6.6 Basic statistical concepts like mean, mode, median, standard deviation, dispersion, Process capability and indices - C_p, C_{pk},

		6.7 Concept of variable data & attribute data, control charts for variables and attributes, 6.8 Concept of Acceptance sampling, sampling plans, O.C. curve, 6.9 Seven Q.C. tools such as ISHIKAWA diagram, scatter diagram, Parato diagram
Unit – VII Recent Trends in Metrology	7a. Describe working principle and purpose of coordinate measuring machine. 7b. Compare multi-gauging inspection and online inspection	7.1 Introduction to CMM 7.2 Working principle, 7.3 Purpose, 7.4 Advantages, 7.5 Classification of CMM, 7.6 Multi Gauging Inspection. 7.7 Online Inspection.

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Title Of Unit	Teaching Hours	Distribution Of Theory Marks			
			R level	U Level	A Level	TOTAL
I	Fundamentals Of Metrology And Basics of Measurement.	08	00	08	04	12
II	Limits, Fits & Gauges	04	00	04	04	08
III	Comparators	04	02	03	03	08
IV	Screw Thread & Gear Measurement	06	02	06	04	12
V	Surface Finish Measurement & Testing Techniques	10	02	12	02	16
VI	Basic Concepts Of Quality And Introduction To SQC	12	04	07	07	18
VII	Recent Trends in Metrology	04	00	04	02	06
	Total	**48**	**10**	**44**	**26**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Sr. No.	Unit	Title Practical/ Lab. Work/ Assignments/ Tutorials	Hours
1	I	Use of basic measuring instruments such as vernier caliper, vernier height gauge, Vernier depth gauge, outside micrometer, inside micrometer for measurement of actual jobs	04

		from industry..	
2	I	Use of slip gauge to find unknown gap. Set the sine bar for given angle and verify the angle by bevel protractor	04
3	III	Use of dial indicator as a mechanical comparator. 50 jobs manufactured on any machine by single operator for a particular dimension is checked as per job drawing with tolerances e.g. O.D. of shaft within 10 microns.	04
4	IV	Use of screw thread micrometer and floating carriage micrometer (Two wire method) to measure effective diameter	04
5	V	Use of surface finish testing machine to observe surface finish (Ra) values for specimens of grinding finish, lapping finish, honing finish, turning, milling, shaping	04
6	IV	Use of gear tooth vernier for chordal thickness and addendum measurement.	02
7	V	Use of optical flat for flatness testing.	02
8	VI	To draw a frequency histogram for a set of 50 readings measured for a particular quality characteristic on 50 jobs from industry. Calculation of standard deviation, process capability.	04
9	VI	To draw X & R chart for a given data of 50 readings actually measured in industry.	02
10	VI	To draw P & C chart for the data taken in the industry.	02
		Total	**32**

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

1. Carry out market survey for various metrological instruments.
2. Analyze the specifications, costs, quality and availability for various types of measuring instruments and equipments.
3. Interact with supplier/trader and discuss about SOP's for use of measuring instruments.
4. Designing software for data acquisition and SQC.
5. Allow students to repeat the experiment in order to achieve complete understanding.
6. Search online PPT's, PDF's, video's on the operation and maintenance of the instruments
7. Search for modern equipments on internet.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars and Industry visits
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

S.No.	Name of Book	Author	Publication
1	Engineering Metrology	R. K. Jain	Khanna Publications
2	Engineering Metrology	P. K. Sinha	BPB Publications
3	Metrology	M.S. Mahajan	DhanapatRai and co. Publications
4	Statistical Quality control	M. S. Mahajan	DhanapatRai and co. Publications
5	Handbook of Metrology		ASTME
6	Quality, Planning and Analysis	J. M. Juran	Tata McGraw Hill Publications
7	IS codes: IS 919-1993 Limit, fits & tolerances IS 2029-1962 Dial gauges IS 2909-1964 Guide for selection of fits IS 2984-1966 Slip gauges		

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

S. No.	Name of equipment	Brief specification
1.	Simple Vernier , simple micrometer, digital Vernier, digital micrometer, height gauge, depth gauge	Depth guage -Range 0-150 mm, with interchangeable anvils
2.	Different types of limit gauges and slip gauges	Slip gauges-M 105 (high standard)
3	Dial indicator and Solex air gauge	As per industry specification
4	Screw thread micrometer and floating carriage micrometer	Base- Made of regged C.I Metal, maximum lagitude measurement

		90 mm, maximum transverse measurement 30 mm each side, list count for zero indicator 0.01mm, list count of micrometer 0.001mm, micromenter range 0-25 mm, Master piece diameter m16 *2 terrain, 1.35 mm (3 wire method)
5	Gear tooth Vernier caliper, Parkinson gear tester	As per industry specification
6	Taylor Hobson Talysurf, Tomlinson surface meter	As per industry specification
7	Autocollimator, optical flats	As per industry specification
8	Surface Roughness Tester	Parameters Ra, Rz, Measuring Range Ra: 0.05 ~10.0 µm Rz: 0.1 ~ 50.0 µm, Cut-off Length 0.25, 0.8 and 2.5 mm, Tracing Length 6 mm, Tracing Speed 1.0 mm/sec, Measuring Lengths 1.25, 4.0 and 5.0 mm, Accuracy: +/-15%, Pick-up: Piezoelectric, Stylus Tip: Diamond, radius 5 +/- 1 µm,Angle: 90° (+5° or -10°)

12. LEARNING WEBSITE & SOFTWARE

a) http://www.bakergauges.com/product-list.php
b) http://www.faro.com/products/faro-software/cam2-measure-10/overview
c) http://www.mitutoyo.co.jp/eng/pdf/E4329_QuickGuide.pdf
d) http://www.mitutoyo.co.jp/eng/
e) http://promec.com.tr/en/services/measurement-test/
f) http://www.sigmetrix.com/case-studies-2/gdt-case-studies-and-whitepapers/gdt-basics/
g) http://www.sigmetrix.com/products/gdt-software/
h) http://www.bombaytools.in/surface-roughness.html
i) http://www.winspc.com/products/winspc

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

S No	Course Outcome	POs										PSOs	
		1	2	3	4	5	6	7	8	9	10	01	02
1	Select relevant measuring instruments for various industrial jobs.	2	3	2	2	1	-	-	-	-	2	2	1
2	Use a standard operating procedure for measurement and calibration.	2	3	3	2	1	-	-	2	1	2	2	2
3	Select proper chart for process capability study of a set of jobs from industry.	2	2	2	2	-	-	-	2	-	1	2	1
4	Set various measuring instruments for different jobs.	2	2	3	2	-	-		1	-	2	2	2
5	Analyze the data obtained from measurement for SQC.	2	3	2	2	-	-	-	1	1	1	2	-

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	A.W Nemade	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad
2	V.M Bukka	Lecturer in Mechanical Engineering, Govt. Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **INTERNAL COMBUSTION ENGINES**

COURSE CODE **6M407**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Sixth

1. RATIONALE

Considering the vital importance of the I.C. engines, it is utmost necessary to give exposure to the diploma engineers as regards the important and basic aspects of I.C. engines. Diploma engineers come across the I.C. engines in his/her all the while in the operating areas of Production, Maintenance, and processing etc. Combustion systems in both the S.I. and C.I. engines are covered with emphasis on detonation Knock, Octane rating and Cetane Rating, I.C. engine fuels like conventional fuels along with Alternative fuels like Methanol, Ethanol, LPG, CNG, Bio-Diesel etc. are also covered. Testing and performance aspects and .Advances in I.C. engines like Wankel engines, Stratified charge I.C. engines, direct injection gasoline engines, variable compression ratio engines are also being covered. The contents in I.C Engines will make student understand & apply the knowledge about various system, subsystems & their inter-relationships

2. COMPETENCY

At the end of studying this course students will be able to "The course content should be taught and implemented with the aim to develop a competency to apply the basics of I.C engine and carry out the trial on four stroke S.I and C.I engines"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE (OR)	PA (TW)	150
4	-	2	6	80	20	25#	25	
Duration of the Examination (Hrs)				03	01	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**;** **ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online Examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

a Maintain the fuel feed system used in S.I and C.I engines.

b Maintain the cooling, lubrication & ignition systems used in S.I and C.I engines.

c Trial on four stroke Petrol/Diesel engine.

d Prepare, analyze and interpret heat balance sheet

e Dismantle and assemble four stroke Petrol / diesel engine / Solex carburetor

f Trial on petrol and diesel exhaust gas analyzer and analyze the results.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I Engine Types And Fuel Feed System	1a. Enlist different types of IC Engines 1b. Differentiate between two stroke and four stroke engines 1c. Components of engines 1d. State applications of I.C. engines 1e. Explain various systems of carburetor 1f. Describe working of simple carburetor 1g. Describe Solex carburetors 1h. Explain MPFI system 1i. Describe fuel Injection	A) INTRODUCTION TO ENGINES AND ITS TYPES 1.1 Types of engines, I.C. Engine classification, 1.2 Two stroke & Four stroke engines 1.3 Petrol & Diesel engine, their construction and working, Comparison 1.4 I.C. engine applications B) S.I. ENGINES: 1.5 Properties of Air-fuel mixture, Mixture requirements for starting, Idling, slow speed and acceleration 1.6 Carburetor : -Working and limitations of simple carburetor. - Working of Solex carburetor 1.7 Multi Port Fuel Injection System (M.P.F.I.) - Concept of Petrol injection - Fuel injection system components like Fuel injector, Fuel pump, Throttle sensor, Oxygen sensor, Engine coolant sensor, Manifold absolute pressure sensor, Mass air flow sensors. ECU & ECU operating engine map. - Limitations of MPFI systems. C) C.I. ENGINES: 1.8 Fuel injection systems- -Requirements and Types of Injection systems

	pump	-Conventional plunger type fuel pump, Rotary fuel pump, -Fuel injectors, Types of nozzles
Unit – II I.C. Engine systems	2a. Describe battery ignition system 2b. Differentiate mechanical and electronic ignition system 2c. State need of cooling system 2d. Describe different types of cooling system 2e. Give advantages of splash lubrication system over pressurized lubrication system	2.1 Ignition System: -Types of ignition systems -Working of Battery and Magneto ignition systems, Electronic ignition systems with and without contact breakers 2.2 Cooling system: -Need of cooling system -Types of cooling systems as Air-cooling system, liquid and pressurized liquid cooling system. -Relative Advantages and disadvantages. 2.3 Lubrication system: -Need of lubrication system -Different lubrication systems like splash, modified splash and pressurized lubrication systems -types of lubricants, lubricant additives and their advantages
Unit – III Combustion in I.C. Engines	3a. Explain stages of Combustion in SI and CI engines 3b. Describe detonation and theories of detonation 3c. State effect of engines variables on knocking 3d. Describe fuel rating 3e. Explain delay period	3.1 Combustion in S.I. engines: -Introduction - Stages of combustion - Effects of engine parameters on ignition lag, flame propagation 3.2 - Abnormal combustion - Detonation or Knocking - Theories of detonation - Effect of engine variables on knocking - Disadvantages and Control of detonation. - Pre ignition - Octane rating of fuel, 3.3. Combustion in C.I. Engines: - Air-fuel ratio in C.I. engines - Stages of combustion - Delay period or ignition lag, 3.4 Diesel knock - Methods of controlling diesel knock 3.5 C.I. engine combustion chambers - Principles of combustion chamber design as Open, Swirl, Man chambers - Cold starting of CI engines.

Unit – IV I.C.Engine Fuels	4a. Explain Structure of Petroleum 4b. Describe refining process 4c. Explain Octane number 4d. Describe Non-Petroleum fuels	4.1 Introduction 4.2 Structure of Petroleum 4.3 Products of refining process 4.4 Fuels for SI engines 4.5 Octane number requirements (ONR) 4.6 Diesel fuels 4.7 Non –petroleum fuels 4.8 Additives 4.9 Alternative fuels such as Alcohols, Bio-diesel& blended fuels
Unit– V Testing And Performance of I.C.Engines	5a. Describe performance parameters 5b. Describe different Measuring instruments 5c. Explain Efficiencies and Specific consumption 5d. Describe heat balance sheet	5.1 Introduction 5.2 Performance parameter 5.3 Basic Measurements Measurements of speed, fuel consumption, air consumption, exhaust smoke, B.P.,I.P. & F.P. Willan's line method, Morse test & Motoring test 5.4 Efficiencies and Specific Fuel Consumption (SFC's) 5.5 Heat balance and heat balance sheet. (Numerical on above testing & performance)
Unit– VI Advances In I. C. Engines	6a. Describe Wankel engine Explain Stratified charge engine 6b. Describe compression ratio engines 6c. Describe Sterling engine 6d. Explain Supercharging of I.C. engines	6.1 Elementary introduction to Wankel engine 6.2 Stratified charge engine (Direct Injection Engines) 6.3 Variable compression ratio engines 6.4 Stirling engines 6.5 Supercharging of I.C. engines. Introduction Objectives of supercharging Supercharging limits Methods of supercharging, multi fuel engines
Unit– VII Environmental Air Pollution & Control	7a. Explain pollution from Petrol 7b. Describe sources of Pollution 7c. Describe Petrol engine emission control 7d. Explain Diesel emission	7.1 Introduction 7.2 Pollutants from petrol engines Sources of pollution Exhaust emissions Effect of engine maintenance on exhaust emissions 7.3 Petrol engine emission control – Engine design modifications Exhaust gas oxidation methods Exhaust emission control by fuel variations Blow by control Control of Oxides of nitrogen by Exhaust Gas Recirculation Method (EGR)

		Total emission package, Thermal reactor package, Catalytic converter, package 7.4 Diesel emission Diesel smoke & control Introduction to driving cycles

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Engine Types and Fuel feed systems	14	04	10	08	22
II	I.C. engine systems	10	02	06	04	12
III	Combustion in I.C. engines	10	02	06	04	12
IV	I.C. engine fuels	06	00	04	02	06
V	Testing and performance of I.C. engines	10	02	06	06	14
VI	Advances in I.C. engines	06	00	02	04	06
VII	Environmental air pollution and control	08	02	04	02	08
	Total	**64**	**12**	**38**	**30**	**80**

Legends: *R – Remember, U – Understand, A – Apply and above (Bloom's revised Taxonomy)*

7. LIST OF PRACTICAL / LABORATORY EXPERIENCES/ TUTORIALS

Perform at least (**10 experiments)** from the list. Teachers are instructed to make use of laboratory model, equipment's and websites matter for best teaching-learning process.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Demo of motorized Multi-cylinder Petrol Engine to study sections of engine, location & function of different parts.	02

2	I	Demo of motorized Multi-cylinder Diesel Engine to study sections of engine, location & function of different parts.	02
3	I	Dismantle and assemble any one type Modern Bike/Scooter Carburetor to study various Carburetion systems & carburetor working	04
4	IV	Demo of Diesel atomization (fog), Injector spray, fuel pump parts& complete working of Diesel supply system of single cylinder Diesel engine (From tank to injector)	02
5	II	Dismantling & assembly of Tappet side of Multi-cylinder engine to study tappet side complete details (Performance on	04
6	I	Dismantling & assembly of Head & Block sections of Multi-cylinder engine to study complete details (Performance on SCODA engine)	04
7	I	Complete Dismantling & assembly of Multi-cylinder engine to study all sections, parts, locations, functions, etc. (Performance on MARUTI 800 engine)	04
8	V	Trial on Fuel Injection Pump (FIP) bench for calibration of Diesel Pump	02
9	VI	Demonstrate a) M.P.F.I. system of Petrol engine b) C.R.D.I. system of Diesel engine	02
10	V	Trial on single cylinder 4-stroke Diesel Engine to calculate i) IP ii) BP iii) Thermal Efficiency iv) Prepare heat balance sheet	04
11	VI	Case study of Firing Order of Four, Five & Six cylinder engines used in cars	02
12	II	Demo of liquid cooling system and lubrication system on actual I.C. engine & animation videos	02
13	VII	Visit to PUC center & collection sample certificates for pollution analysis. Comparative study of Bharat stage 4 & Bharat stage 6 norms	02
14		Demonstrate & study of Battery and Magneto Ignition systems on	02

		actual cars & using audio-visuals from website	
15		Search of information/videos about Exhaust gas analyzer & EGR systems in engines and prepare presentation based on it. (minimum 10 PPTs)	04
			32 Hrs

8. SUGGESTED STUDENTS ACTIVITIES

Other than class room and laboratory activities following are the suggested guided co-curricular student's activities which need to be undertaken to facilitate the attainment of various course outcomes of this course. The students are required to maintain portfolio of their experiences which he/ she will submit at the end of the term.

a. Prepare a report on multi cylinder engines / single cylinder engines and other sub - assemblies/systems available in mechatronics (Mercedez Benz) & Yamaha Training School.

b. Prepare a report on engine testing/component testing/PUC testing available in institute and nearby centers.

c. Visit to a small garage to observe the trouble shooting of various systems present in th I.C. engine.

9. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Improved Lecture methods-
b. Q & A technique.
c. Demonstration
d. Seminars
e. Activity based learning

10. SUGGESTED LEARNING RESOURCE

Sr.No.	Title of Book	Author	Publication
1	Internal Combustion Engines	Mathur and Sharma,	Dhanpatrai and Sons
2	Internal Combustion Engines	Ganeshan,	TMH
3	Internal Combustion Engines	Maleev	Dhanpatrai and Sons
4	High Speed Internal Combustion Engines	Ricardo	Dhanpatrai and Sons
5	Internal Combustion Engines	Obert	TMH
6	Mechanical Engineering	KirpalsinghVol I and Vol II	Standard publications
7	Mechanical Engineering	R.P.Sharma ,S.CHAND	Dhanpatrai& sons
8	Diesel Engines	- Heissler –SAE publications	Standard publications

11. LIST OF MAJOR EQUIPMENTS AND MATERIALS REQUIRED :

Sr.No.	Name of the Equipment	Specification
1	Four stroke petrol engine.	As per given specification
2	Four stroke diesel engine.	As per given specification
3	Two stroke petrol engine.	As per given specification
4	Four-stroke petrol engine test rig	As per given specification
5	Four stroke diesel engine test rig	As per given specification
6	Solex carburetor.	As per given specification
7	MPFI system of car like Maruti ,Hyundai, Indica	As per given specification
8	Battery and Magneto Ignition systems.	As per given specification
9	Exhaust gas analyzer	As per given specification
10	EGR systems in engines	As per given specification

12. LEARNING WEBSITE & SOFTWARE

1	https://www.nptel.ac.in/courses
2	https://www.k12reader.com
3.	https://www.eduaction.com
4.	https://www.k5learning.com
5.	https://www.english4u.com

13. MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

CO. NO.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	Maintain the fuel feed system used in S.I and C.I engines	2	3	1	1	1	1	-	-	-	1	-	1
CO2	Maintain the cooling, lubrication & ignition systems used in S.I and C.I engines.	1	2	3	2	1	1	-	-	-	2	2	3
CO3	Trial on four stroke Petrol/Diesel engine.	1	2	3	3	1	1	-	1	1	1	3	2
CO4	Prepare, analyze and interpret heat balance sheet	2	2	2	2	-	1	-	1	1	1	2	-
CO5	Dismantle and assemble four stroke Petrol / diesel engine / Solex carburetor	1	2	2	2	-	-	-	3	-	2	1	2
CO6	Trial on petrol and diesel exhaust gas analyzer and analyze the results.	1	2	3	3	1	3	2	1	1	1	2	2

Course Curriculum Design Committee

Sr No	Name of the faculty members	Designation and Institute
1	R.N Khadse	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
2	G.G Ghuge	Lecturer in Mechanical Engineering, Govt. Polytechnic,Aurangabad
3	V.B Kumavat	Lecturer in Mechanical Engineering, Govt Polytechnic, Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

COURSE TITLE **VOCATIONAL TRAINING**

COURSE CODE **6M503**

PROGRAMME & SEMESTER

Diploma Programme in which this course is offered	Semester in which offered
Mechanical	Sixth

1. RATIONALE

A technician is responsible for the quality supervision, production/construction/ development and repairs and maintenance of different engineering machines / equipment's / structures in related area of engineering. Vocational training course is mainly integrated with theoretical knowledge and practical experiences and various situations of performing the jobs correctly actually on sites / Industries. While working in the industry a technician is employed for planning, preparation, supervision, and quality control. Arrangement of materials, labours and equipment's are also the additional role of a technician. Vocational training will provide an opportunity to relate theoretical knowledge and its field / industry applications, quality assurance of processes and safety measures. It also provides hands on experience of various activities and standard practices along with enhancement of employability skills.

2. COMPETENCY

At the end of studying this course students will be able to

"Relate, verify and apply theoretical knowledge and procedures to field / industrial practice and situations through observation, participation and hands on experience to supervise the manufacturing/construction/ development and maintenance of engineering entities as a self / wage employee"

3. TEACHING AND EXAMNATION SCHEME

Teaching Scheme (Hours/ Credits)			Total Credits (L+T+P)	Examination Scheme (Marks)				
				Theory		Practical		Total
L	T	P	C	ESE	PT	ESE @ (PR/OR)	PA (TW)	100
-	-	4	4	--	--	50#	50	
Duration of the Examination (Hrs)				--	--	--	--	

Legends : L-Lecture**; T-**Tutorial/Teacher Guided Theory Practice **; P-** Practical**; C-** Credits**; ESE-** End Semester Examination**; PT – Progressive Test, PA-** Progressive Assessment, OR – Oral Examination, TW - Term Work, # External, @ Internal,~ Online examination.

4. COURSE OUTCOMES

At the end of studying this course students will be able to: -

1. Supervise various processes in manufacturing / erection / execution and maintenance of machines / systems / machines as per standard code of practices.
2. Assists in project planning, execution, monitoring and management.
3. Identify and solve the field problems and communicate effectively to various agencies / Stake- holders.
4. Plan and observe safety measures in Industry / field.
5. Test the materials / products / works for its conformity with quality parameters.
6. Prepare a Report of training experiences.

5. DETAILED COURSE CONTENTS

Following are the general guidelines for implementation of Vocational training

1 Student studying in Final year diploma engineering program is expected to work in group 4-5 students for vocational training. Each group shall work under the guidance of a regular employee (engineer) of the industry as a trainee in a Major (Large) /medium /small industry (Civil/Mechanical/ Electrical/Electronic Computer/IT/Garment manufacturing) for four weeks. (This includes 3/ 4 days of orientation, 3 weeks of working in industry and report preparation in sixth semester (2hrs /week).

2 Finally the students in group shall prepare the report of his vocational training under the guidance of the teaching staff members which may consists of observations, drawings, sketches, sample calculations / simple designs, processes, procedures, applications, managements, costing aspects. Student should deliver a seminar on his training experiences.

3 Vocational Training is to be undertaken after fifth semester's end examination.)

Role of Department:

1. Department have to send training request letter to various industries well in advance before commencement of training.
2. After getting sufficient number of seats from the industries/garages, students will be placed in different industries/garages for their 5th semester training.
3. Students will have to fill up training form.(attached here with form-1)
4. Department will issue an order letter to industry for the said training mentioning the name and registration number of students.
5. All above activities have to be carried out in advance of previous semester as plan out of placement in consultation with industry & students.
6. During the training period, the head of the department will maintain a schedule for follow – up of industrial training and according to it he/she will send the guide faculty members to various industries.
7. The faculty member during the visit to industry will check the progress of the student in the training, his/ her attendance, discipline and daily diary preparation.
8. The department has to keep record of above progressive assessment during visits of teachers to industry.
9. At the end of the training internal faculty member and industry representative will assess the work done by student based on his presentation at the institute and training report.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	A	Term work Identify the industry. Take concerns and depute the groups along with faculty members. Daily Visits for vocational	32* Hrs- Min Semester Break Activity. 32 Hours in sixth semester.

		training, Completion of training by maintaining daily dairy under guidance of site / Industry Engineer and faculty. (Following activities B-I to B IV may also be considered during this period)	
2.	B- I	Collect and analyze site / industry data on Planning, preparation, erecting, production, manufacturing & quality control aspects as per the daily dairy recorded at site / industry.	08
3	B-II	Preparing rough draft along with collected drawings. Maps and designs / calculations or tables.	08
4	B-III	Group discussion in presence of guide Give presentation - ppts / models / charts / drawings etc. in a group .	08
5	B-IV	Prepare Final draft with all attachments. Spiral Binding of the vocational training work and term work completion.	08
Total Hours.			32* + 32 = 64 hrs

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

I) Aspects to be considered for Vocational training / report writing of it.

a. Planning, preparation & quality control for various activities and processes.
b. Management of materials, labor's & equipment's,
c. To solve the minor industrial problems.
d. Develop the Entrepreneurial skills.
e. Develop ability to work in a team.
f. To enhance the presentation skills
g. Vocational training reports preparations & cost analysis,
h. To be familiar with financial sources.

II) SUGGESTED AREAS FOR THE VOCATIONAL TRAINING WORK (PROGRAMME SPECIFIC) FOR:MECHANICAL

(FOLLOWING INDUSTRIES OR ANY OTHER APPLICABLE INDUSTRY SUGGESTED BY TEACHER)

Sr. No	Area of Mechanical Engineering	Suggested Industries
1	Automobile field	Automobile Service Station Auto workshop / Garage ST workshop/ City transport workshop Automobile manufacturing / auto component manufacturing units Auto Engine Testing unit Wheel Balancing unit
2	Manufacturing field/ Processing field	Engineering Workshop ,CNC shop Tool mfg. unit. ,fabrication unit Plastic material processing unit Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant. Food processing unit. auto component manufacturing units Mechanical component manufacturing units Heat treatment plants Machine mfg. industries. Forging industry. Steel mfg. indutry.
3	Measurement /Quality control /Testing field	Material testing laboratories in industries Quality control labs in industries. Calibration centre units. Measurement Lab.
4	Refrigeration and Air Conditioning.	Dairy Plant Ice plant Refrigeration and air conditioning component manufacturing. Refrigeration and air conditioning servicing units Cold storage.
5	Design /CAD-CENTRE.	Design software industries.
6	Govt./Non-Govt. Agency	IGTR tool room. CIPET. Marathawada Auto-cluster.

7. SUGGESTED SPECIFIC INSTRUCTIONAL STRATERGIES

These are sample strategies, which a teacher can use to facilitate the attainment of course outcomes.

a. Consider Local / Institute problem or problem related to society for providing technical solution.

b. Visit the site.

c. Take permission of concerned authority.

d. Follow Instructions.

e. Write daily dairy regularly at site.

f. Prepare sketches on dairy / on plain pages.

g. Collect drawings and leaflets.

h. Group discussions.

i. Prepare report.

j. Prepare power point presentation for final assessment of vocational training.

A) VOCATIONAL TRAINING REPORT FORMAT:

Title page
- Certificate
- Abstract
- Acknowledgement
- Index

• Introduction of industry/garage

Industry lay out (at training place)

• Hierarchy of industry/organization chart.

• Types of major equipment's/instruments/machines used in industry with their specification, approximate cost and specific use.

• Particulars of Practical Experiences in industry.
• Additional data/information on – cost reduction, repair , Safety features, cost estimates of major repairs, modifications, etc.

• Special/challenging experiences encountered during training if any

• References

• Bibliography

REPORT FORMAT

a. Vocational Training report shall be in the print form on A-4 size white bond paper.

b. Typing shall be in Times New Roman with spacing of 1.5 using one side of paper.

c. Margins: Left = 37.5 mm Right , Top and Bottom = 25mm.

d. Front page : Titles - TNR 18 bold , other – TNR 14 bold. With Institute Logo.

e. Inner Pages : Titles –TNR – 14 Bold , other TNR 12 .

f. Page Nos :Should appear on the right hand top corner of each page starting after index page.

g. Tables to be preferable in the Text format only.

h. Sketches to be drawn on separate sheet / pages in black ink .

i. The Last content in the index to be of references. Acknowledgement to be added in the report.

Binding: Spiral binding is preferred for the Vocational training report. The number of copies are to be prepared by the student are 7 nos. (if, 5 Student + Guide +Department Copy)

B) DAILY DIARY FORMAT

GOVERNMENT POLYTECHNIC, AURANGABAD

Mechanical Engineering Department

VOCATIONAL TRAINING DAILY DIARY

Period of Vocational training (4 Weeks) : From : to:

Address of Industry / Site:----------

DAY NO : Date:

OBSERVATIONS OF THE DAY

Signature of Student Signature of Engineer In-charge

Signature of Guide Signature of Head of Dept.

C:PERMISSION LETTER:

Government Polytechnic Aurangabad
(An Autonomous institute of Govt. of Maharashtra)
Osmanpura, Aurangabad.
Phone : 2334724/2321917/2353644 Resi: 2331562
GRAM : POLYTECH Fax "2334724 E-mail:
gpaur@rediffmail.com

No.GPA/Mechanical/In-plant tra./
Date: / /

To,

Subject: placement for In-plant Training for the Final Year Students from date …..
To …….
Dear sir,
It is my pleasure to inform you that, Government Polytechnic, Aurangabad is an Autonomous Institute of Maharashtra since 1994. This Institute has introduced In-plant Training of the student as a part of curriculum of the final year Mechanical Engineering Diploma in addition to the project work with a view to provide an opportunity of the industrial exposure to the Mechanical Engineering Students.
During the In-plant Training Students are expected to learn by attending the construction site and record or observe the various technical details /daily constructional activities with the problem solving methods in – liaison with the site Engineer In – charge of the project. Student will be working / observing the activity of the construction under the guidance of the Site Engineer, without causing any inconvenience in a day to day functioning of the site for the said period. Later our student will prepare a brief report for the same and will submit to this institute as a part of their term – work for further assessment. Students are required to develop the following skill during their training.

1. Planning data collection, process and execution of the project.
2. Material, labour and equipment management.
3. Constructional and cost aspects.
4. Progress and comparisons.
5. Quality control and entrepreneurship aspects.

Kindly grant the permission for the placement of the following group of students at your industry for the guidance to our students in order to gain the industrial experience during the In-plant Training work.

Sr No	Enrollment No	Name of the student	Mobile no of student	Name of the guide sign & mobile no

Thanking you sir, and co – operation from your end expected for this academic work.

Principal,
Govt. Polytechnic,
Aurangabad

Government Polytechnic Aurangabad
(An Autonomous institute of Govt. of Maharashtra)
Osmanpura, Aurangabad.
Phone : 2334724/2321917/2353644 Resi: 2331562
GRAM : POLYTECH Fax "2334724 E-mail:
gpaur@rediffmail.com

No.GPA/Mechanical/In-plant tra./20-
Date : / /20

UNDERTAKING TO BE SUBMITTED BY THE STUDENTS UNDERGOING IN – PLANT TRANING

I, the undersigned students of final year Mechanical Engineering of this Institute for the academic year 2014-15 hereby give undertaking to abide by the below rules stipulated by the Department of Mechanical Engineering, Government Polytechnic Aurangabad.

The rules to abide by me during the In-plant Training shall be,

1. I shall report the industry / organization on the stipulated scheduled without fail.
2. I shall observe and follow all the rules enforced by the industry / organization.
3. I shall attend the work at the industry of placement as per the schedule.

4. I shall bear the transportation, food and other charges if required for the daily visits to the industry during the training schedule.
5. I shall observe all the safety precaution at the deputed site during the training.
6. I shall take whole responsibility regarding any untoward incidents or any mishaps occurred at the site and will not make any claims of compensation from Government Polytechnic, Aurangabad or from the deputed industry / organization as I am attending the same as per my wish.
7. I shall obey the instruction of my guide and the Site Engineer during the training.
8. I shall work at the construction site In – liaison with Site Engineer, without causing any inconvenience day to day functioning of the deputed site for the said period.
9. I shall be liable for action for any indiscipline during the training period.
10. I shall collect the certificate of attendance and relieving letter from the industry.

Date:
Place : Aurangabad
Name of Guide:

Signature :
Name of Student:
Enrollment No:
Mobile No:
Permanent address:

CERTIFICATE

This is to certify that Mr.----------of Final year having Enrollment No ---------- of Government Polytechnic, Aurangabad, attended and completed the In – Plant Training successfully at this site during the period from ----------to ----------

Date :

Place : Seal Signature

8.SUGGESTED LEARNING RESOURCE

Visit to institute library to find the related text books.

Sr No	Title of Book	Author	Publication
1	As per site details / area of vocational training.	Refer Books , I.S. Codes, Hand Books , Standard specifications, Manuals of Govt Depts, National and Inter-national journals.	

9. Major Equipment/ Instrument with Broad Specifications

1. Daily Diary write up and taking signature of In-charge Engineer.
2. Interactions with, Managers /Engineers, Contractors, Trainers ,technicians, and labours at site/field
3. Report preparation and Final presentation of work done.

10. LEARNING WEBSITES:

Search on WEB for related construction / Industrial sites.

1. www.google.com
2. www.youtube.com
3. websites related to Mechanical Engg.sites.

11.MAPPING OF PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs) WITH COURSE OUTCOMES (COs)

O. NO.	Course Outcome	Programme Outcomes										PSO1	PSO2
		1	2	3	4	5	6	7	8	9	10		
CO1	Supervise various processes in /manufacturing / erection / execution and maintenance of machines / systems / machines as per standard code of	--	3	--	3	--	--	--	---	--	--	--	2

	practices												
CO2	Assists in project planning, execution, monitoring and management	--	1	--	---	--	--	--	---	---	--	--	2
CO3	Identify and solve the field problems and communicate effectively to various agencies / stake-holders.	---	--	3	3	---	---	--	1	--	--	1	
CO4	Plan and observe safety measures in Industry / field	--	2	3	--	--	--	---	--	--	--	2	2
CO5	Test the materials / products / works for its conformity with quality parameters.	--	3	--	--	--	--	--	2	--	--	2	2
CO6	Prepare a Report of training experiences	--	3	3	---	--	---	---	---	--	--	--	2

Course Curriculum Design Committee

Sr. No	Name of the faculty members	Designation and Institute
1.	Smt.J.S.Patil	Head of Department Civil Engg. Govt. Polytechnic, Aurangabad.
2.	Shri. Y.N.Shaikh	Lecturer in Civil Engineering, Govt. Polytechnic,Aurangabad

(Member Secretary PBOS) (Chairman PBOS)

EQUIVALANCE SUBJECT FROM 3RD to 4th REVISION

3rd revision Curriculum					4th revision Curriculum					Diff. in credit	
Course code	Course name	Theory credits	Practical credits	Total Credits	Course code	Course name	Theory credits	Practical credits	Total Credits	Plus	Minus
GE151	Communication skill	2	2	4	4G301	English	3	2	5	1	
GE152	Basic Mathematics	4	0	4	4G101	Basic Mathematics(BMT)	4	0	4	0	
GE153	Engineering Mathematics	4	0	4	4G102	Engineering Mathematics (EMT)	4	0	4	0	
GE154	Basics Science	3	2	5	4G104	Engineering Chemistry	4	2	6	1	
GE155	Applied Science	3	2	5	4G103	Engineering Physics	4	2	6	1	
GE156	Workshop Practice	0	4	4	4G105	Work Shop Practice (WP)	0	3	3		1
GE157	Engineering Graphics	1	2	3	4G106	Engineering Graphics (EGR)	2	2	4	1	
GE158	Basics of computer systems	1	2	3	4G107	Basics of Computer System (BCS)	1	2	3	0	
ME251	Workshop Technology	2	4	6	4M208	Mechanical Technology	2	3	5		1
ME252	Electrical Engineering	2	2	4	4M301	Basics of electrical Engineering and Electronics	4	2	6		2
ME253	Basic Electronics	2	2	4							
ME254	Engineering Drawing	2	4	6	4M201	Engineering Drawing	2	4	6		0
ME255	Engineering Mechanics	3	2	5	4M204	Applied Mechanics	4	2	6	1	
ME256	Theory of Machines	4	2	6	4M406	Theory of Machines	3	2	5		1
ME257	Thermal Engineering	3	2	5	4M205	Thermal Engineering	3	2	5	0	
ME258	Manufacturing Processes	2	4	6	4M202	Manufacturing Processes	2	4	6	0	
ME259	Strength Of Materials	3	2	5	4M412	Strength Of Materials	4	2	6	1	

3rd revision Curriculum					4th revision Curriculum					Diff. in credit	
Course code	Course name	Theory credits	Practical credits	Total Credits	Course code	Course name	Theory credits	Practical credits	Total Credits	Plus	Minus
ME260	Fluid Power	3	2	5	4M401	Fluid Power	3	2	5	0	
ME261	Machine Drawing	2	4	6	4 M402	Machine Drawing	2	4	6	0	
GE371	Material Management	3		3	4M415	Material Management	4	2	6	3	
GE372	Financial Management	3		3	4G305	Industrial Management	3	2	5	2	
GE373	Marketing Management	3		3	4G305	Industrial Management	3	2	5	2	
GE374	Production Management	3		3	4G305	Industrial Management	3	2	5	2	
GE375	Industrial Management	3		3	4G305	Industrial Management	3	2	5	2	
ME376	Mechanical Measurement	2	2	4	4M203	Measurement & Controls	3	2	5	1	
ME377	Computer Aided Drafting	1	4	5		No equivalent subject					
ME378	3-D Modeling	1	3	4	4M407	3-D Modeling	1	4	5	1	
ME379	Mechanical Engineering Materials	3	2	5	4M411	Mechanical Engineering Materials	3	2	5	0	
ME380	Industrial Visits	0	4	4	4M413	Implant Training	0	4	4	0	
ME451	Production Processes	3	4	7	4M202	Manufacturing Processes	2	4	6		1
ME452	Entrepreneurship Development	3	3	6	4G303	No equivalent subject					
ME453	Heat Power Engineering	4	2	6	4M405	Heat Power Engineering	3	2	5		1
ME454	Tool Engineering	4	2	6	4M410	Tool Engineering	3	2	5		1
ME455	Design of Machine Elements	4	2	6	4M501	Design of Machine Elements.	4	2	6	0	
ME456	Seminar	0	3	3	4M404	Seminar	0	2	2		1
ME457	Project	0	4	4	4M403	Project	0	4	4	0	

3rd revision Curriculum					4th revision Curriculum					Diff. in credit	
Course code	Course name	Theory credits	Practical credits	Total Credits	Course code	Course name	Theory credits	Practical credits	Total Credits	Plus	Minus
ME458	Automobile Engineering	3	2	5	4M418	Automobile Engineering	4	2	6	1	
ME459	Mechanical Estimation and Costing	3	2	5		Any other subject					
ME460	Refrigeration and Airconditioning	3	2	5	4M416	Refrigeration and Air-conditioning	4	2	6	1	
ME461	Industrial Engineering	3	2	5	4M503	Production Engineering	3	2	5	0	
ME462	Power Plant Engineering	3	2	5	4M414	Power plant Engineering	4	2	6	1	
ME463	Mechatronics	3	2	5		No equivalent subject					
ME551	CNC Machines	2	4	6	4M408	Computer Integrated Machining	2	3	5		1
ME552	Advanced Manufacturing Processes	3	4	7	4M409	Advanced Manufacturing Processes	3	4	7	0	
ME553	Metrology and Quality Control	4	3	7	4M502	Metrology and Quality Control	3	4	7	0	
ME555	Advance Manufacturing Systems	3	0	3	4M505	Advance Manufacturing Systems	4	2	6	3	
ME556	Industrial Pollution and Control	3	0	3	4G304	No equivalent subject					
ME557	Alternate Energy Sources	3	0	3	4M506	Alternate Energy Sources	4	2	6	3	
ME558	Computational Techniques	3	0	3		No equivalent subject					
ME559	Industrial Psychology	3	0	3		No equivalent subject					
ME560	Industrial Laws	3	0	3		No equivalent subject					
NEW COURSES ADDED IN 4TH REVISION					4M206	Development of life skills	2	2	4		

	4M207	Professional Practices	0	3	3		
	4G302	Communication Skill	2	2	4		
	4G303	Entrepreneurship Development	2	2	4		
	4M417	Advance Mathematics	4	2	6		
	4M507	Marketing Management	4	2	6		
	4M508	C-Programming	4	2	6		
	4M509	Production Planning & Control	4	2	6		

EQUIVALANCE SUBJECT FOR 3rd, 4th , 5th AND 6th REVISION

(Abbreviations for allotted credits: Theory: T1, Practical: P, Tutorial: T2, Total: TT)

3rd revision		4th revision					5th revision					6th revision						Diff in credit	
Course code	Course name	Course code	Course name	T1	P	TT	Course code	Course name	T1	Pr	TT	Course code	Course name	T1	P	T 2	TT	plus	Minus
GE151	Communication skill	4G301	English	3	2	5	5G301	English	2	2	4	6G301	English	2	2	-	4	_	_
GE152	Basic Mathematics	4G101	Basic Mathematics	4	0	4	5G101	Basic Mathematics	4	0	4	6G101	Basic Mathematics	3	0	1	4	_	_
GE153	Engineering Mathematics	4G102	Engineering Mathematics	4	0	4	5G102	Engineering Mathematics	4	0	4	6G102	Engineering Mathematics	3	0	1	4	_	_
GE154	Basics Science	4G104	Engineering Chemistry	4	2	6	5G104	Engineering Chemistry	3	2	5	6G104	Engineering Chemistry	3	2	-	5	_	_
GE155	Applied Science	4G103	Engineering Physics	4	2	6	5G103	Engineering Physics	3	2	5	6G103	Engineering Physics	3	2	-	5	_	_
GE156	Workshop Practice	4G105	Work Shop Practice	0	3	3	5G105	Work Shop Practice	0	3	3	6G202	Work Shop Practice	0	3	-	3	_	_
GE157	Engineering Graphics	4G106	Engineering Graphics	2	2	4	5G106	Engineering Graphics	2	2	4	6G201	Engineering Graphics	2	2	-	4	_	_
GE158	Basics of computer systems	4G107	Basics of Computer System	1	2	3	5G107	Basics of Computer System	1	2	3	6G203	Basics of Computer System	0	2	-	2	_	1
ME251	Workshop Technology	4M208	Mechanical Technology	2	3	5	5R208	Mechanical Technology	2	3	5	6M204	Mechanical Technology	3	3	-	6	1	_
ME252	Electrical Engineering	4M301	Basics of electrical Engineering and Electronics	4	2	6	5R301	Basics of electrical Engg. and Electronics	4	2	6	6R203	Basics of electrical Engg. and Electronics	4	2	-	6	_	_
ME253	Basic Electronics																		
ME254	Engineering Drawing	4M201	Engineering Drawing	2	4	6	5R201	Engineering Drawing	2	4	6	6R201	Engineering Drawing	2	4	-	6	_	_

3rd revision		4th revision					5th revision					6th revision						Diff in credit	
Course code	Course name	Course code	Course name	T1	P	TT	Course code	Course name	T1	Pr	TT	Course code	Course name	T1	P	T 2	TT	plus	Minus
ME255	Engineering Mechanics	4M204	Applied Mechanics	4	2	6	5Q201	Applied Mechanics	4	2	6	6Q201	Engineering Mechanics	4	2	-	6	_	_
ME256	Theory of Machines	4M406	Theory of Machines	3	2	5	5R406	Theory of Machines	3	2	5	6M206	Theory of Machines	3	2	-	5	_	_
ME257	Thermal Engineering	4M205	Thermal Engineering	3	2	5	5M205	Thermal Engineering	3	2	5	6M205	Thermal Engineering	3	2	-	5	_	_
ME258	Manufacturing Processes	4M202	Manufacturing Processes	2	4	6	5M202	Manufacturing Processes	2	4	6	6M202	Machining Processes	2	4	-	6	_	_
ME259	Strength Of Materials	4M412	Strength Of Materials	4	2	6	5Q202	Strength Of Materials	3	2	5	6R202	Strength Of Materials	3	2	-	5	_	_
ME260	Fluid Power	4M401	Fluid Power	3	2	5	5R401	Fluid Power	3	2	5	6M401	Fluid mech. & machinery	3	2	-	5		
												6M402	Industrial Fluid power	3	2	-	5		
ME261	Machine Drawing	4 M402	Machine Drawing	2	4	6	5R402	Machine Drawing	2	4	6	6M403	Machine Drawing	2	4	-	6	_	_
GE371	Material Management	4M415	Material Management	4	2	6	5M415	Material Management	4	2	6	6G305	Industrial org & Management	3	2		5	1	_
GE372	Financial Management	4G305	Industrial Management	3	2	5	5G305	Industrial Management	3	2	5	6G305	Industrial org & Management	3	2	-	5	_	_
GE373	Marketing Management	4G305	Industrial Management	3	2	5	5G305	Industrial Management	3	2	5	6G305	Industrial org & Management	3	2	-	5	_	_
GE374	Production Management	4G305	Industrial Management	3	2	5	5G305	Industrial Management	3	2	5	6G305	Industrial org & Management	3	2	-	5	_	_
ME376	Mechanical Measurement	4M203	Measurement & Controls	3	2	5	5M203	Measurement & Controls	3	2	5	6M207	Measurement & Controls	3	2	1	6	1	_
ME378	3-D Modeling	4M407	3-D Modeling	1	4	5	5R407	3-D Modeling	1	2	3	6M405	3-D Modeling	1	2	-	3	_	_
ME379	Mechanical Engineering Materials	4M411	Mechanical Engineering Materials	3	2	5	5R411	Mechanical Engineering Materials	3	2	5	6M410	Mechanical Engineering Materials	3	2	-	5	_	_
ME380	Industrial Visits	4M413	Implant Training	0	4	4	5R412	Industrial visit	0	2	2	6M503	Vocational Training	0	4	0	4	2	_
ME451	Production Processes	4M202	Manufacturing Processes	2	4	6	5M202	Manufacturing Processes	2	4	6	6M202	Machining Processes	2	4	-	6	_	_
ME453	Heat Power	4M405	Heat Power	3	2	5	5M405	Heat Power	3	2	5	6M404	Heat Power	3	2	-	5	_	_

	Engineering		Engineering					Engineering					Engineering						
3rd revision		4th revision					5th revision					6th revision						Diff in credit	
Course code	Course name	Course code	Course name	T1	P	TT	Course code	Course name	T1	Pr	TT	Course code	Course name	T1	P	T 2	TT	plus	Minus
ME454	Tool Engineering	4M410	Tool Engineering	3	2	5	5M410	Tool Engineering	3	2	5	6M409	Tool Engineering	3	2	-	5	_	_
ME455	Design of Machine Elements	4M501	Design of Machine Elements.	4	2	6	5M501	Design of Machine Elements.	4	2	6	6M504	Design of Machine Elements.	4	2	-	6	_	_
ME456	Seminar	4M404	Seminar	0	2	2	5R404	Seminar	0	2	2	6M501	Seminar	0	2	-	2	_	_
ME457	Project	4M403	Project	0	4	4	5R403	Project	0	4	4	6M502	Project	0	4	-	4	_	_
ME458	Automobile Engineering	4M418	Automobile Engineering	4	2	6	5M417	Automobile Engineering	4	2	6	6M413	Automobile Engineering	4	2	-	6	_	_
ME460	Refrigeration and Airconditioning	4M416	Refrigeration And Air-conditioning	4	2	6	5M416	Refrigeration and Air-conditioning	4	2	6	6M412	Refrigeration and Air-conditioning	4	2	-	6	_	_
ME461	Industrial Engineering	4M503	Production Engineering	3	2	5	5M503	Production Engineering	3	2	5	6M506	Production Engineering	3	2	-	5	_	_
ME462	Power plant Engineering	4M414	Power plant Engineering	4	2	6	5M414	Power plant Engineering	4	2	6	6M411	Power plant Engineering	4	2	-	6	_	_
ME555	CNC Machines	4M408	Computer Integrated Machining	2	3	5	5M408	Computer Integrated Machining	1	2	3	6M406	Computer Integrated Machining	2	2	-	4	1	_
ME552	Advanced Manufacturing Processes	4M409	Advanced Manufacturing Processes	3	4	7	5M409	Advanced Manufacturing Processes	3	4	7	6M408	Advanced Manufacturing Processes	3	4	-	7	_	_
ME553	Metrology and Quality Control	4M502	Metrology and Quality Control	3	4	7	5R502	Metrology and Quality Control	3	2	5	6M505	Metrology and Quality Control	3	2	-	5	_	_
ME554	IC Engines	4M504	IC Engines	4	2	6	5R504	IC Engines	4	2	6	6M407	IC Engines	4	2	-	6	_	_
ME555	Advance Manufacturing Systems	4M505	Advance Manufacturing Systems	4	2	6	5M505	Advance Manufacturing Systems	4	2	6	6M507	Advance Manufacturing Systems	4	2	-	6	_	_
ME557	Alternate Energy	4M506	Alternate	4	2	6	5M506	Alternate	4	2	6	6M508	Alternate	4	2	-	6	_	_

	Sources		Energy Sources					Energy Sources					Energy Sources						
		4th revision					5th revision					6th revision						Diff in credit	
Course code	Course name	Course code	Course name	T1	P	TT	Course code	Course name	T1	Pr	TT	Course code	Course name	T1	P	T 2	TT	plus	Minus
		4M206	Development of life skills	2	2	4	5R206	Development of life skills	0	2	2	6G303	Development of life skills	0	2	-	2	_	_
		4M207	Professional Practices	0	3	3	5R207	Professional Practices	0	2	2	6M208	Computer aided drafting	1	2	-	3	1	0
		4G302	Communication Skill	2	2	4	5G302	Communication Skill	1	2	3	6G302	Communication Skills	1	2	-	3	_	_
		4G303	Entreprenurship Develpoment	2	2	4	5G303	Entreprenurship Develpoment	2	2	4	6G306	Entreprenurship Develpoment	2	2	-	4	_	_
		4M417	Advance Mathematics	4	2	6	5M417	Advance Mathematics	4	2	6	No Equivalent courses							
		4M507	Marketing Management	4	2	6	5M507	Marketing Management	4	2	6								
		4M508	C-Programming	2	2	4	5M508	C-Programming	4	2	6								
		4M509	Production Planning & Control	0	3	3	5M509	Production Planning & Control	4	2	6	6M509	Production Planning & Control	4	2	-	6	_	_
		4G304	Enviromental Science	2	0	2	5G304	Enviromental Science	2	0	2	6G304	Enviromental Science	0	2	-	2	_	_
New Courses added in 6th revision.												6M503	Vocational Training	0	4	-	4		
												6M208	Computer aided drafting	1	2	-	3		
												6M402	Industrial Fluid Power	3	2	-	5		