GOVERNMENT POLYTECHNIC, KOLHAPUR

(An Autonomous Institute of Government of Maharashtra)

Curriculum Document

CURRICULUM: MPECS-2023

(Outcome Based Curriculum)

for

DIPLOMA IN MECHANICAL ENGINEERING

Secretary **Chairman**

Programme-wise Board of Studies (PBOS)
Mechanical Engineering Programme
Government Polytechnic, Kolhapur

INDEX

SECTION – I
CURRICULUM PHILOSOPHY AND STRUCTURE

1. CURRICULUM DEVELOPMENT: INTRODUCTION AND PROCESS OF DEVELOPMENT OF OUTCOME BASED CURRICULUM

Curriculum Design and Development:

Curriculum is an absolute instructional and effective instrument designed with a student-centered approach. It incorporates systematic method of teaching learning process. It is a sequence of planned academic activities; on completion of which the desired programme outcomes are expected to be attained in the student. The curriculum and the course contents are expected to motivate the students to acquire desired level of knowledge and skills. An emphasis and an attempt have been made in the curriculum to get a perfect blending of theoretical concepts and actual requirements of industry. Keen attention has been provided to make it more structured by incorporating the valuable suggestions of industrial experts of PBOSs and feedback by the field and academic professionals. An overview of systematic and scientific mode of implementation and evaluation has also been pondered; consequently, a practicable model of it has been achieved. It incorporates specific guidelines and assessment criteria for theory/practical/oral modes of evaluation. Specification table for each course has been provided to prepare question paper justifying meticulous coverage.

Curriculum philosophy:

The impact of globalization and rapid changes in the engineering science and technology have been a great cause of comprehensive and noticeable change in engineering fraternity, hence the institutions. Only way to incorporate such a transformation, is to modify the curriculum, preserving the consistency of engineering education. Frequent review and feedback from the experts and the freedom of autonomous status of the institution have encouraged to undertake relevant changes in the curriculum to make it versatile. Consequently, the desired competencies and skills are transformed amongst the students in pursuing their preparedness to cope up with the global changes. It aims to promote self-reliance and satisfaction of acquiring modern engineering concepts and multi capabilities within the students to make them model technicians.

"Curriculum is an educational program designed and implemented to achieve specified Programme outcomes"

Hence, in a broad sense, a curriculum incorporates the following:

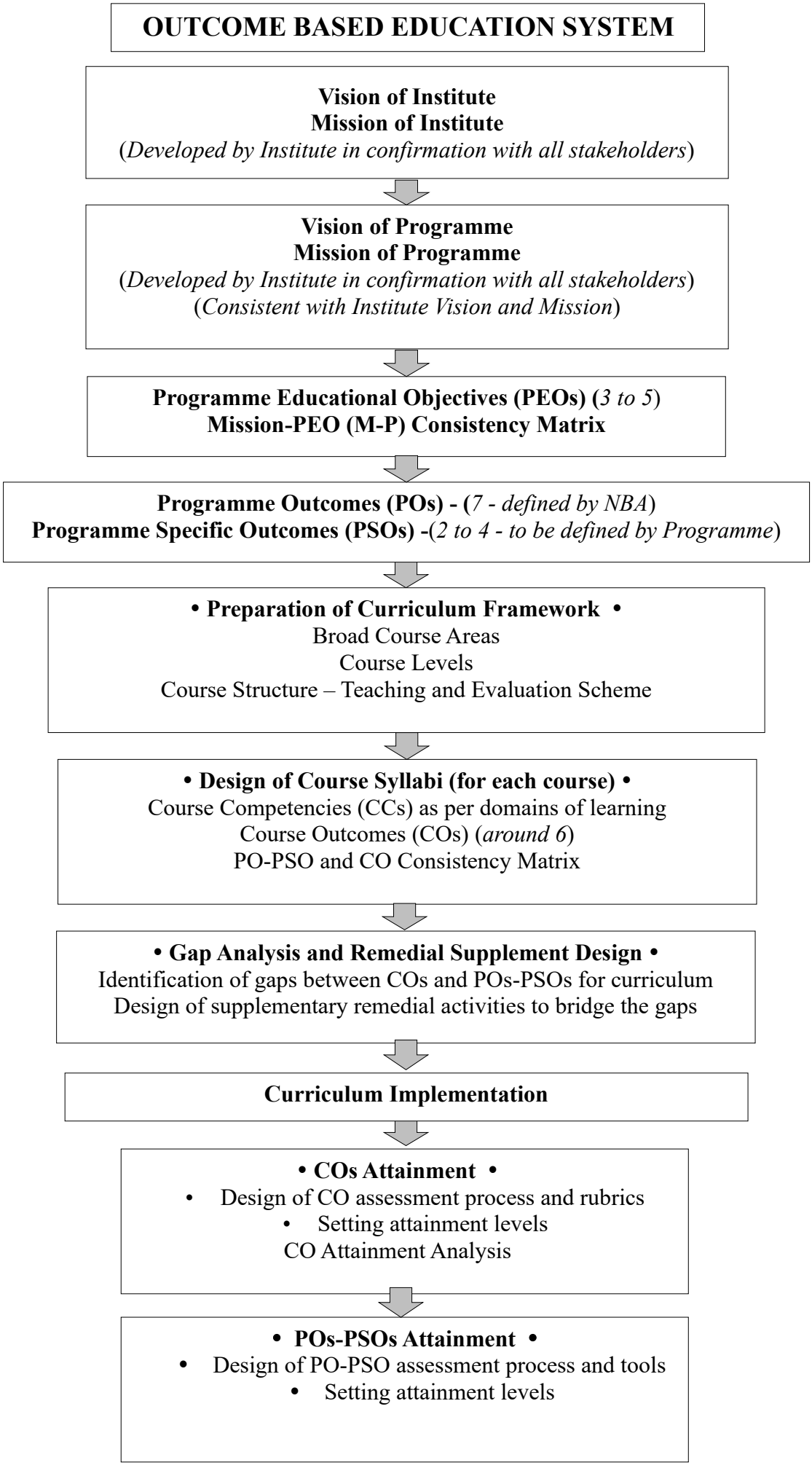
- To define the purpose of education
- To accept systematic planning methods
- To confirm implementation strategies
- To identify and to incorporate needs of industries
- To follow the policy directives
- To cope-up with social concerns
- To aim at personality development of students

- To allow future developments and challenges in emerging science and technology.

Outcome-based Curriculum

Outcome based curriculum is the curriculum based on the concepts of outcome-based education (OBE) philosophy. India is a permanent signatory of the Washington Accord - the international agreement among bodies responsible for accrediting engineering programmes with the National Board of Accreditation (NBA) as the national authority for accrediting degree and diploma programmes in engineering in India. Hence as per the accreditation criteria of the NBA, the curriculum of the Institute is expected to be outcome based.

Outcome Based Education (OBE) is an educational approach in which all the activities of an education system are based on attainment of pre-defined learning outcomes of student. The approach is to be included in the following three aspects of education system: i) Curriculum Design, ii) Curriculum Implementation, iii) Students' Evaluation. The flow diagram shown below summarizes the elements of Outcome-based Education System. The glossary of terms used in academic autonomy and OBE are provided for reference.


OUTCOME BASED EDUCATION SYSTEM
Vision of Institute
Mission of Institute
(Developed by Institute in confirmation with all stakeholders)
Vision of Programme
Mission of Programme
(Developed by Institute in confirmation with all stakeholders)
(Consistent with Institute Vision and Mission)
Programme Educational Objectives (PEOs) (3 to 5)
Mission-PEO (M-P) Consistency Matrix
Programme Outcomes (POs) - (7 - defined by NBA)
Programme Specific Outcomes (PSOs) -(2 to 4 - to be defined by Programme)
• Preparation of Curriculum Framework •
Broad Course Areas
Course Levels
Course Structure – Teaching and Evaluation Scheme
• Design of Course Syllabi (for each course) •
Course Competencies (CCs) as per domains of learning
Course Outcomes (COs) (around 6)
PO-PSO and CO Consistency Matrix
• Gap Analysis and Remedial Supplement Design •
Identification of gaps between COs and POs-PSOs for curriculum
Design of supplementary remedial activities to bridge the gaps
Curriculum Implementation
• COs Attainment •
• Design of CO assessment process and rubrics
• Setting attainment levels
CO Attainment Analysis
• POs-PSOs Attainment •
• Design of PO-PSO assessment process and tools
• Setting attainment levels

Glossary of terms related to Outcome Based Education

Outcome-Based Education (OBE) - It is an educational approach in which all the activities of an education system are based on attainment of pre-defined learning outcomes of student.

The approach is to be included in the following three aspects of education system:
i) Curriculum Design, ii) Curriculum Implementation, iii) Students' Evaluation

Washington Accord and NBA–It is an International Agreement among bodies responsible for accrediting undergraduate engineering degree programmes. Established in 1989, the signatory countries as of 2014 are Australia, Canada, Taiwan, Hong Kong, India, Ireland, Japan, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Sri Lanka, Turkey, the United Kingdom and the United States. National Board of Accreditation (NBA), India has become the permanent signatory member of the Washington Accord on 13thJune 2014.

The membership of Washington Accord is an international recognition of the quality of undergraduate engineering education offered by the member country and is an avenue to bring it into the world class category. It encourages and facilitates the mobility of engineering graduates and professionals at international level.

NBA accreditation is a quality assurance scheme for higher technical education in India.

The Washington Accord covers engineering degrees and diploma under outcome-based education approach.

Vision of Institute - It is a statement that defines concisely the aspirations to be achieved in the near future by the Institute

Mission of Institute - It is a set of statements that defines the broad steps to be executed to achieve the vision of the Institute

Vision of Programme - It is the vision statement for a particular educational programme (like Civil Engineering Programme, Mechanical Engineering Programme, etc.). Programme Vision should be consistent with the Institute vision

Mission of Programme - It is the set of statements that define the broad steps to be executed to achieve the vision of the educational programme

Programme Educational Objectives (PEOs) - It is a set of 3 to 5 statements defining the objectives to be attained in order to execute the mission

Programme Outcomes (POs) – It is a set of ten generic outcomes, stated by NBA, expected from any engineering diploma-holder in India

Programme-specific Outcomes (PSOs) – It is a set of 2 to 4 outcomes to be defined by the programme under consideration in addition to the Pos

Course Outcomes (COs) – It a set of about 6 outcomes, expected to be attained by student on learning a course. Course Outcomes shall be defined in curriculum for each course. Course outcomes are worded using action verbs like solve, explain, calculate, compare, distinguish, describe, draw, etc.

Mission-PEO Consistency Matrix – It is a matrix showing degree of consistency of PEOs with mission

PO-CO Consistency Matrix – It is a matrix showing degree of consistency of COs with POs and PSOs

Competency – It is the set of specific abilities, categorized as cognitive, psychomotor and affective domains of learning, from which course outcomes statements are derived

Cognitive domain –It is the set of abilities related to thinking

Bloom's Revised Taxonomy of Cognitive Domain: It is a six-level cumulative hierarchy of cognitive abilities in the order of increasing complexity as follows:

Remembering > *Understanding* > *Applying* > *Analyzing* > *Evaluating* > *Creating*

Psychomotor Domain: It is the set of abilities related to physical and psychological skills

Taxonomy of Psychomotor Domain: It is a six-level cumulative hierarchy of cognitive abilities in the order of increasing complexity as follows:

Perception > *Set*> *Guided response*>*Mechanism* > *Adaptation* >*Origination*

Affective Domain: It is the set of abilities related to attitudinal development

Taxonomy of Affective Domain: It is a five-level cumulative hierarchy of affective abilities in the order of increasing complexity as follows:

Receiving > *Responding* > *Valuing* > *Organizing* >*Characterizing*

Educational Technology: It is the systematic study of theoretical foundations and material tools to facilitate learning

Glossary of terms used in Academic Autonomy and MPECS

Academic Autonomy – It is the freedom and responsibility offered to the Institute by the Government to attain high quality standards in the following three dimensions:
i) Design of own curricula ii) Conduct of own examinations iii) Award of own diploma

Multi-point Entry and Credit System (MPECS) – It is a system of education in which student can be admitted at different entry levels of qualification and he is offered *credits* along with marks on passing in a course

Credits – It is the number of weekly instructional hours provided for a course in the curriculum

Programme – It is the particular branch of Engineering in which Diploma is awarded. e.g. Civil Engineering Programme, Mechanical Engineering Programme, etc.

Curriculum – It is a document providing plan of the complete academic activity to be conducted by student for award of Diploma in a Programme in tune with the vision of the Institute

Course – It is a particular subject defining study and evaluation unit of the curriculum. e.g., Applied Mechanics, Engineering Drawing-1, etc.

Syllabus – It is the complete academic information regarding a particular course in a curriculum

Course Registration (CR) -It is the procedure to be carried out by every student at the beginning of every semester in which he/she has to declare the courses he/she is going to study in that semester as per academic time table of the Institute. The registration is to be done as per *Rules of Registration* of the Institute.

Examination Registration (ER) -It is the procedure to be carried out by every student at the beginning of every semester in which he/she has to declare the courses in which he/she is going appear for examination in that semester as per examination time table of the Institute. The registration is to be done as per *Rules of Registration* of the Institute.

Curriculum MPECS-2023 - It is the Curriculum of the Institute revised in the year 2023. It is applicable to the students admitted since 2023.

Programme Department – It is the department of the Institute offering Diploma in a particular Programme. e.g., Civil Engineering Department, Mechanical Engineering Department, etc.

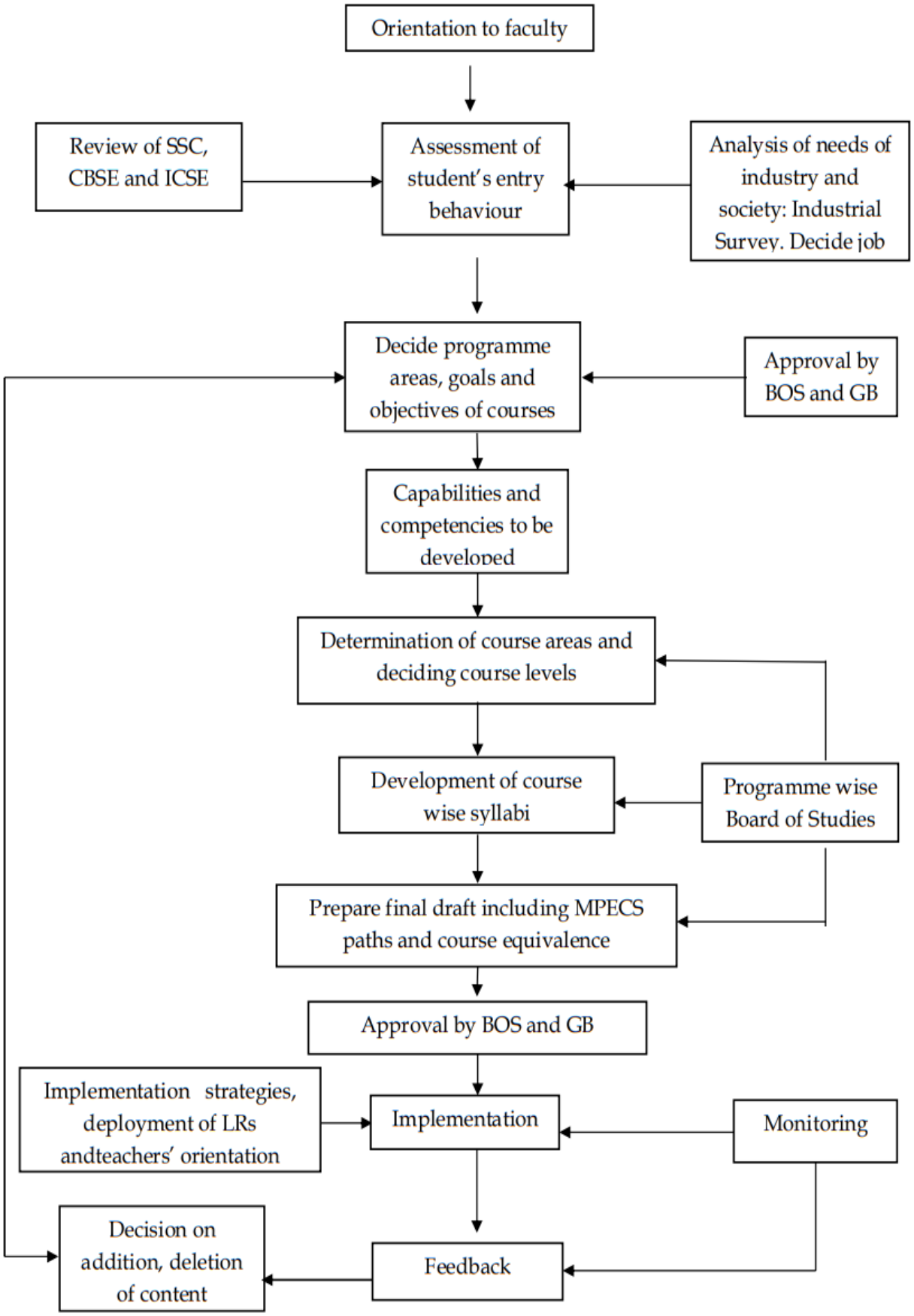
Programme Dean – He/she is the Head of Department of a Programme Department.

Allied Department – It is department that does not award diploma and contributes to curriculum implementation of many Programmes. e.g. Applied Mechanics Department, Workshop Department, Science Department, English Department, Mathematics Department, etc.

Academic Autonomy and MPECS at Government Polytechnic, Kolhapur –

- Year of award of academic autonomy: 1992
  Government Polytechnic, Kolhapur is the first Government Polytechnic in Maharashtra to have been awarded academic autonomy
- Year of award of MPECS and Flexibility: 1994
- Bodies and Cells under Academic Autonomy:
  i) Governing Body
  ii) Board of Studies
  iii) Programme-wise Boards of Studies
- Examination Committee Curriculum Revisions under Autonomy: 1992, MPECS-2001, MPECS-2006, MPECS-2010, MPECS-2013, MPECS-2016, MPECS 2020, MPECS 2023.
- Award of Diploma in *Convocation Ceremony* every year.

Curriculum Development Model:



2. VISION, MISSION, PROGRAMME EDUCATIONAL OBJECTIVES (PEOs), PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Vision of Institute:

Institute of high recognition developing competent technicians for quality services or entrepreneurship to cater the needs of industry and society.

Mission of Institute:

- To educate and train in multi-disciplinary multi-level programmes to develop technicians and skilled manpower having global competency
- To ensure employability, encourage entrepreneurship, promote lifelong learning
- To inculcate in the students the qualities of a good citizen at individual, social and professional level
- To provide quality management system with focus on effective student-centric education
- To utilize faculty expertise and Institute infrastructure to render quality consultancy services

Vision of Mechanical Engineering Programme:

Internationally recognized programme for development of mechanical engineering technicians providing platform for entrepreneurship and incubation for industry of the country.

Mission of Mechanical Engineering Programme:

- To educate and train students for employment or entrepreneurship or higher education in mechanical engineering
- To provide student centric learning system having focus on development of global professional competency
- To inculcate elements of holistic personality, responsible citizenship and social concern

Programme Educational Objectives (PEOs):

Within three years of Diploma, students are able to –

1. Be employed as a practicing engineer in the fields of manufacturing and service sectors.
2. Assume positions of leadership and responsibility within an organization.
3. Progress through higher education and certificate programs in Engineering and other professionally related fields.
4. Startup own service or manufacturing enterprise.

5. Apply a set of moral principles to all interactions with stakeholders.

Programme Outcomes (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

Programme Specific Outcomes (PSOs)

1. Learner will be able to work in manufacturing and service sectors as a production supervisor, quality inspector, design and drafting assistant, maintenance engineer, planning assistant.
2. Start entrepreneurial activity in the Mechanical Engineering field.

Job profiles and related Competencies for the diploma holder

The curriculum for mechanical Engineering Programme is primarily aligned with National Education Policy (NEP) 2020, developed with the focus on small, medium size mechanical engineering enterprises & large size organization in & around the region. The enterprises will be production, manufacturing, sales, repairs & maintenance, services to the community etc. The enterprises may be private sector, public sector govt. sector where diploma holders in mechanical engineering may work as supervisor, technician, junior engineer, assistant manager or he may become an entrepreneur.

The main aims of mechanical engineering programme are to induce the following qualities in the diploma holders.

Social Skills

1) To be a good citizen.
2) Answer question and proposals in appropriate manner.
3) Prepare impact instructions to pears/subordinates.
4) Write letter, report & proposals in appropriate manner.
5) Develop an attitude to work in team for achieving goals.
6) Develop listening skill and respect for other operations.
7) To learn how to use library literature and gathering of information.
8) Develop skill to work independently for problem solving.
9) To develop creative thinking.
10) Awareness of Government Rules.

Technical Skills

1) Apply problem solving models to arrive at proper solutions of technical problems.
2) Develop supervisory and managerial skills.
3) Use of different types of measuring instruments.
4) Use of statistical quality control techniques used in industries.
5) Apply decision making techniques.
6) Detect faults and repairs of mechanical units.
7) Design machine parts by applying standard design procedure.
8) Selection of different types of materials.
9) Calculation of standard time.
10) Conduct time study and method study by using standard methods.
11) Preparing process sheets & flow charts.
12) Selection of different types of cutting tools.
13) Selection of machining parameters.
14) Selection of different types of lubricants & coolants.
15) Selection of various machines tools.
16) Design of simple jigs & fixtures.
17) Draw, read, interpret working drawings.
18) Use of PERT & CPM techniques.
19) Prepare simple program for CNC machine.
20) Use of various safety devices.
21) Estimating product cost.
22) Preparation of Project report.
23) Market Survey.
24) Selection of Engines for different application.
25) Load calculations for refrigeration and air conditioning systems.
26) Selection of various parts and equipments used for different refrigeration and air conditioning systems.

27) Detect and rectify the faults of refrigeration and air conditioning.
28) Use of Garage tools and maintenance.
29) Calculate performance characteristics of I.C. Engines and Hydraulic machineries.
30) Use of drafting software.
31) Prepare simple computer program and execute.
32) Elementary exposure to ISO.

Aims of Mechanical Engineering Programme are prepared in order to have various technical skills and abilities to be acquired by the diploma holders in mechanical engineering, so that he can fulfill industrial requirements precisely.

Considering these aims, the contents of Mechanical Engineering Program is divided in six semesters. In First and Second semester, students will be exposed to introductory aspects of foundation courses, like Mathematics, Engineering Drawing, Physics, Chemistry, Mechanical Workshop Practices etc. From these semesters, students will acquire basic knowledge of above said courses which is required for higher levels. Life Skills and Professional Skills courses which cover Communication Skills, Introduction to IT System, Environmental Education and Sustainability and Indian Constitution which impart students to acquire social and professional skill.

Semester Third, Fourth and Fifth are of basic technology courses which are prepared to induce necessary skills, abilities and knowledge of different mechanical engineering courses like Thermal Engineering, Machine Drawing, Engineering Metallurgy, Engineering Metrology and Measurement, Theory of Machines and Computer Aided Drafting etc.

Also, these semesters include applied technology courses. Content of these is structured to impart skills, abilities and knowledge of advanced mechanical engineering courses like Power Engineering, Machine Design, Fluid Mechanics and Machinery, Mechanical Measurements, Advanced Machining Processes and Solid Modeling, Industrial Hydraulics and Pneumatics, Tool Engineering, Welding Technology, Foundry Technology, Automobile Engineering and Refrigeration and Air Conditioning. Students are also exposed to specialized fields like maintenance, instrumentation, 3D Modeling and CNC machines.

Management and diversified courses are also included. These courses are designed to develop managerial skills, abilities and knowledge of Industrial Engineering and Quality control, Industrial Organization and Management and Entrepreneurship and Startup.

Contents of all six semester courses are structured in sequential and logical manner so as to cover cognitive, psychomotor, and affective domains of learning.

3. OVERVIEW AND SALIENT FEATURES OF CURRICULUM: MPECS-2023

3.1 Overview of Curriculum MPECS-2023

Total No. of Credits		
No. of courses offered	Total	44
	Theory	31
Max. no. courses in a semester		8
Total Maximum Marks		5100
Courses in Semester 1	No.	7
	Credits	20
	Marks	825
Courses in Semester 2	No.	6
	Credits	20
	Marks	850
Courses in Semester 3	No.	7
	Credits	20
	Marks	875
Courses in Semester 4	No.	8
	Credits	20
	Marks	850
Courses in Semester 5	No.	6
	Credits	20
	Marks	800
Courses in Semester 6	No.	7
	Credits	20
	Marks	900
%Ratio of Th:Pr	Credit-wise	
	Marks-wise	
No. of Allied Courses		2
Optional Courses	No. of courses	2
	Options/course	3
No. of Practical Exams	External	12
	Internal	13

Diploma shall be awarded on the basis of marks obtained in Third Year courses (Semester 5th and Semester 6th Marks)

3.2 Salient Features of Curriculum MPECS-2023

Addition and deletion of Courses with respect to MPECS-2020:

- In the MPECS 2023 the levels are removed, DIPLOMA QUALIFYING MARKS are of 3rd year that is the addition of 5th semester and 6 semester Marks.
- In MPECS 2023 all semesters are made of equal credits and each is of 20 credits.
- More emphasis is given on practicals to get practical knowledge required in industry.
- In MPECS 2023 Indian knowledge system hours are added in the course to get technical knowledge of our ancient Indian history.
- In the first semester the assessment of course Engineering Chemistry is made online as per the MSBTE Curriculum having online FA TH and Online SA TH.
- In the first semester the course Communication skills in English is renamed as communication skills.
- The course Yoga and Meditation is given one credit which was a non-credit subject in earlier MPECS 2020.
- The non-credit subject Environment Science is renamed as Environmental Education and Sustainability with 2 credits and having Online FA TH and SA TH Assessment and is added in 4th semester.
- The previous courses Engineering Mathematics and Applied Mathematics are combined together and named as Applied Mathematics and included in second semester.
- In the second semester the assessment of course Engineering Physics is made online as per the MSBTE Curriculum having online FA TH and Online SA TH.
- The course Manufacturing Processes is shifted from third semester to second semester.
- Social and Life Skills course is added in second semester which will provide students the knowledge of social and professional life.
- In third semester course named Strength of Materials is renamed as Mechanics of Materials.
- The course Fluid Mechanics and Machinery is shifted from 5th semester to 3rd semester.
- The course Fundamentals of Python Programming having one credit is added in 3rd semester to get fundamental knowledge of programming language.
- The course Engineering Metrology and Mechanical Engineering Measurements are combined together to form a course Metrology and Measurements.
- The course CNC Programming is added in 4th semester to get student knowledge about CNC programming.
- The courses Internship-1 of 4 weeks and Internship-2 of 3 weeks are combined together to Internship of 16 weeks.
- The previous non-credit course Entrepreneurship Development is renamed as Entrepreneurship and Startups which is of one credit.
- Machine design is renamed as Design of Machine Elements and is shifted to 6th semester.
- A new Course Industrial Robotics Automation a theory course is made compulsory having FA TH and SA TH.
- Instead of three electives only two electives are given having three course options each.
- The Course from previous Elective-1, Emerging Trends in Mechanical Engineering is made compulsory.

Changes in Implementation Strategy and Treatment with respect to MPECS-2020: In MPECS 2020 curriculum there were 9 elective courses equally arranged in 3 groups (3 in each group) out of that 2 groups are continued in MPECS2023.

4. CURRICULUM STRUCTURE

4.1 PATH-WISE COURSE STRUCTURES (MPECS 2023)

Path-1: Students admitted to First Year - X std. and X std. Tech pass outs

First Semester

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
														FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
							CL	TL	LL					Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	BASIC MATHEMATICS	HBMT	AEC	1	CCH105	4	4	2	-	2	8	4	3	30	70	100	40	-	-	-	-	25	10	125
2	ENGINEERING CHEMISTRY- B	HCHB	DSC	1	CCH104	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
3	ENGINEERING GRAPHICS	HGRB	DSC	1	CCH106	2	2	-	4	-	6	3	4	30	70	100	40	50	20	-	-	-	-	150
4	COMMUNICATION SKILLS	HCMS	AEC	2	CCH201	0	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
5	MECHANICAL WORKSHOP PRACTICES	HMWP	SEC	1	MEH101	2	-	-	4	-	4	2		-	-	-	-	50	20	50@	20	-	-	100
6	FUNDAMENTALS OF ICT	HICT	SEC	2	CCH202	0	1	-	2	1	4	2		-	-	-	-	25	10	25@	10	25	10	75
7	YOGA AND MEDITATION	HYAM	VEC	2	CCH203	1	-	-	1	1	2	1		-	-	-	-	25	10	-	-	25	10	50
Total						**13**	**15**	**2**	**15**	**8**	**40**	**20**		**120**	**280**	**400**		**200**		**100**		**125**		**825**
Second Semester																								
8	APPLIED MATHEMATICS	HAMT	AEC	3	CCH301	2	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100
9	ENGINEERING PHYSICS-B	HPHB	DSC	1	CCH102	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
10	ENGINEERING DRAWING (ME/MT)	HEDR	AEC	1	CCH110	4	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
11	APPLIED MECHANICS	HAPM	DSC	1	CCH108	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
12	MANUFACTURING PROCESSES	HMPR	SEC	3	MEH301	1	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
13	SOCIAL AND LIFE SKILLS	HSLS	VEC	2	CCH204	-	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
Total						**13**	**17**	**2**	**12**	**9**	**40**	**20**		**150**	**350**	**500**		**100**		**100**		**150**		**850**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
Third Semester																								
14	THERMAL ENGINEERING	HTEG	DSC	3	MEH302	-	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
15	PRODUCTION DRAWING	HPDR	SEC	3	MEH303	-	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
16	MECHANICS OF MATERIALS	HMOM	DSC	3	MEH305	1	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
17	FLUID MECHANICS AND MACHINERY	HFMM	DSC	3	MEH306	1	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
18	BASIC ELECTRICAL & ELECTRONICS	HBEE	AEC	3	MEH309	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
19	COMPUTER AIDED DRAFTING	HCAD	SEC	3	MEH315	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
20	FUNDAMENTALS OF PYTHON PROGRAMMING	HFPP	AEC	3	MEH320	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
Total						**2**	**17**	**0**	**18**	**5**	**40**	**20**		**150**	**350**	**500**		**175**		**125**		**75**		**875**
Fourth Semester																								
21	THEORY OF MACHINES	HTOM	DSC	3	MEH308	-	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
22	ENGINEERING METALLURGY	HEMT	DSC	3	MEH310	-	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
23	METROLOGY AND MEASUREMENT	HMAM	DSC	3	MEH314	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
24	ADVANCED MACHINING PROCESSES	HAMP	DSC	3	MEH317	-	4	-	4	-	8	4	3	30	70	100	40	25	10	25@	10	-	-	150
25	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	HEES	VEC	2	CCH206	-	2	-	-	2	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
26	BASICS OF MECHATRONICS	HBOM	AEC	3	MEH318	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
27	CNC PROGRAMMING	HCNC	DSC	3	MEH319	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
28	ESSENCE OF INDIAN CONSTITUTION	HEIC	VEC	2	CCH205	-	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
Total						**0**	**19**		**16**	**05**	**40**	**20**	**-**	**150**	**350**	**500**	**-**	**150**	**-**	**100**	**-**	**100**	**-**	**850**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
														FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
							CL	TL	LL					Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
Fifth Semester																								
29	INTERNSHIP (16 WEEKS)	HINP	INP	5	CCH505	-	**16 weeks Training**					10						100	40	100#	40			200
30	INDUSTRIAL ORGANIZATION AND MANAGEMENT	HIOM	VEC	5	CCH502		5*	-	-	1	6	2	1	15*#	35*#	50	20	-	-	-	-	50	20	100
31	ENTREPRENEURSHIP AND STARTUPS	HESU	AEC	5	CCH501	-	2*	-	-	1	3	1	-	-	-	-	-			-	-	50	20	50
32	PROJECT	HPRJ	AEC	5	MEH513		-	-	2	2	4	1								50#	20	50	20	100
33	POWER ENGINEERING	HPER	DSC	4	MEH401	-	8	-	4	2	14	3	3	30	70	100	40	25	10	25#	10	25	10	175
34	INDUSTRIAL HYDRAULICS AND PNEUMATICS	HIHP	DSC	5	MEH507	-	8	-	4	2	14	3	3	30	70	100	40	25	10	25#	10	25	10	175
Total						**-**	**23**		**10**	**8**	**41**	**20**		**75**	**175**	**250**		**150**		**200**		**200**		**800**
Sixth Semester																								
35	DESIGN OF MACHINE ELEMENTS	HDME	DSC	4	MEH402	-	4	-	2	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
36	INDUSTRIAL ROBOTICS AND AUTOMATION	HIRA	DSE	5	MEH503	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10			150
37	EMERGING TRENDS IN MECHANICAL ENGINEERING	HETM	DSC	5	MEH511	-	3	-	-	1	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
38	3D MODELLING AND ADDITIVE MANUFACTURING	HTMA	SEC	4	MEH414	-	-	-	4	2	6	3	-	-	-	-	-	25	10	50#	20	25	10	100
39	ELECTIVE-I (MEH504 TO MEH506)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40	ELECTIVE-II (MEH508 TO MEH510)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Total						**0**	**19**		**12**	**9**	**40**	**20**		**150**	**350**	**500**		**125**		**150**		**125**		**900**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
TOTAL												**120**				**2650**		**900**		**775**		**775**		**5100**
ELECTIVE- I COURSES																								
39-A	FOUNDRY TECHNOLOGY	HFTN	DSE	5	MEH504	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
39-B	TOOL ENGINEERING	HTLE	DSE	5	MEH505	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
39-C	AUTOMOBILE ENGINEERING	HAEN	DSE	5	MEH506	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
ELECTIVE- II COURSES																								
40-A	INDUSTRIAL ENGINEERING AND QUALITY CONTROL	HIEQ	DSC	5	MEH508	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40-B	WELDING TECHNOLOGY	HWTN	DSC	5	MEH509	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40-C	REFRIGERATION AND AIR CONDITIONING	HRAC	DSC	5	MEH510	-	4	-	2	2	8	4	3.0	30	70	100	40	25	10	25#	10	25	10	175

Path-2: Students admitted directly to Second Year with XII Science (PCM/PCMB)

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
Third Semester																								
14	THERMAL ENGINEERING	HTEG	DSC	3	MEH302	-	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
15	PRODUCTION DRAWING	HPDR	SEC	3	MEH303	-	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
16	MECHANICS OF MATERIALS	HMOM	DSC	3	MEH305	1	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
17	FLUID MECHANICS AND MACHINERY	HFMM	DSC	3	MEH306	1	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
18	BASIC ELECTRICAL & ELECTRONICS	HBEE	AEC	3	MEH309	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
19	COMPUTER AIDED DRAFTING	HCAD	SEC	3	MEH315	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
20	FUNDAMENTALS OF PYTHON PROGRAMMING	HFPP	AEC	3	MEH320	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
					Total	**2**	**17**	**0**	**18**	**5**	**40**	**20**		**150**	**350**	**500**		**175**		**125**		**75**		**875**
Fourth Semester																								
21	THEORY OF MACHINES	HTOM	DSC	3	MEH308	-	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
22	ENGINEERING METALLURGY	HEMT	DSC	3	MEH310	-	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
23	METROLOGY AND MEASUREMENT	HMAM	DSC	3	MEH314	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
24	ADVANCED MACHINING PROCESSES	HAMP	DSC	3	MEH317	-	4	-	4	-	8	4	3	30	70	100	40	25	10	25@	10	-	-	150
25	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	HEES	VEC	2	CCH206	-	2	-	-	2	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
26	BASICS OF MECHATRONICS	HBOM	AEC	3	MEH318	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
27	CNC PROGRAMMING	HCNC	DSC	3	MEH319	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
28	ESSENCE OF INDIAN CONSTITUTION	HEIC	VEC	2	CCH205	-	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
					Total	**0**	**19**		**16**	**05**	**40**	**20**	**-**	**150**	**350**	**500**	**-**	**150**	**-**	**100**	**-**	**100**	**-**	**850**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
Fifth Semester																								
29	INTERNSHIP (16 WEEKS)	HINP	INP	5	CCH505	-	5*	-	-	1	6	10						100	40	100#	40			200
30	INDUSTRIAL ORGANIZATION AND MANAGEMENT	HIOM	VEC	5	CCH502		2*	–	-	1	3	2	1	15*#	35*#	50	20	-	-	-	-	50	20	100
31	ENTREPRENEURSHIP AND STARTUPS	HESU	AEC	5	CCH501	-	-	-	2	2	4	1	-	-	-	-	-			-	-	50	20	50
32	PROJECT	HPRJ	AEC	5	MEH513							1								50#	20	50	20	100
33	POWER ENGINEERING	HPER	DSC	4	MEH401	-	8	-	4	2	14	3	3	30	70	100	40	25	10	25#	10	25	10	175
34	INDUSTRIAL HYDRAULICS AND PNEUMATICS	HIHP	DSC	5	MEH507	-	8	-	4	2	14	3	3	30	70	100	40	25	10	25#	10	25	10	175
Total						**-**	**23**		**10**	**8**	**41**	**20**		**75**	**175**	**250**		**150**		**200**		**200**		**800**
Sixth Semester																								
35	DESIGN OF MACHINE ELEMENTS	HDME	DSC	4	MEH402	-	4	-	2	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
36	INDUSTRIAL ROBOTICS AND AUTOMATION	HIRA	DSE	5	MEH503	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10			150
37	EMERGING TRENDS IN MECHANICAL ENGINEERING	HETM	DSC	5	MEH511	-	3	-	-	1	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
38	3D MODELLING AND ADDITIVE MANUFACTURING	HTMA	SEC	4	MEH414	-	-	-	4	2	6	3	-	-	-	-	-	25	10	50#	20	25	10	100
39	ELECTIVE-I (MEH504 TO MEH506)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40	ELECTIVE-II (MEH508 TO MEH510)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Total						**0**	**19**		**12**	**9**	**40**	**20**		**150**	**350**	**500**		**125**		**150**		**125**		**900**
TOTAL												**120**				**2650**		**900**		**775**		**775**		**5100**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
ELECTIVE- I COURSES																								
39-A	FOUNDRY TECHNOLOGY	HFTN	DSE	5	MEH504	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
39-B	TOOL ENGINEERING	HTLE	DSE	5	MEH505	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
39-C	AUTOMOBILE ENGINEERING	HAEN	DSE	5	MEH506	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
ELECTIVE- II COURSES																								
40-A	INDUSTRIAL ENGINEERING AND QUALITY CONTROL	HIEQ	DSC	5	MEH508	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40-B	WELDING TECHNOLOGY	HWTN	DSC	5	MEH509	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40-C	REFRIGERATION AND AIR CONDITIONING	HRAC	DSC	5	MEH510	-	4	-	2	2	8	4	3.0	30	70	100	40	25	10	25#	10	25	10	175

Note: Separate *Supplementary Input Sessions* for necessary content of First Year courses shall be designed and arranged for these students so as to bridge the gap of FY courses

Path-3 -Branch Change Path Structure

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
														Practical										
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
Third Semester																								
14	THERMAL ENGINEERING	HTEG	DSC	3	MEH302	-	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
15	PRODUCTION DRAWING	HPDR	SEC	3	MEH303	-	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
16	MECHANICS OF MATERIALS	HMOM	DSC	3	MEH305	1	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
17	FLUID MECHANICS AND MACHINERY	HFMM	DSC	3	MEH306	1	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
18	BASIC ELECTRICAL & ELECTRONICS	HBEE	AEC	3	MEH309	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
19	COMPUTER AIDED DRAFTING	HCAD	SEC	3	MEH315	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
20	FUNDAMENTALS OF PYTHON PROGRAMMING	HFPP	AEC	3	MEH320	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
					Total	**2**	**17**	**0**	**18**	**5**	**40**	**20**		**150**	**350**	**500**		**175**		**125**		**75**		**875**
Fourth Semester																								
21	THEORY OF MACHINES	HTOM	DSC	3	MEH308	-	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
22	ENGINEERING METALLURGY	HEMT	DSC	3	MEH310	-	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
23	METROLOGY AND MEASUREMENT	HMAM	DSC	3	MEH314	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
24	ADVANCED MACHINING PROCESSES	HAMP	DSC	3	MEH317	-	4	-	4	-	8	4	3	30	70	100	40	25	10	25@	10	-	-	150
25	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	HEES	VEC	2	CCH206	-	2	-	-	2	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
26	BASICS OF MECHATRONICS	HBOM	AEC	3	MEH318	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
27	CNC PROGRAMMING	HCNC	DSC	3	MEH319	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
28	ESSENCE OF INDIAN CONSTITUTION	HEIC	VEC	2	CCH205	-	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
					Total	**0**	**19**		**16**	**05**	**40**	**20**	**-**	**150**	**350**	**500**	**-**	**150**	**-**	**100**	**-**	**100**	**-**	**850**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
Fifth Semester																								
29	INTERNSHIP (16 WEEKS)	HINP	INP	5	CCH505	-	5*	-	-	1	6	10						100	40	100#	40			200
30	INDUSTRIAL ORGANIZATION AND MANAGEMENT	HIOM	VEC	5	CCH502		2*	–	-	1	3	2	1	15*#	35*#	50	20	-	-	-	-	50	20	100
31	ENTREPRENEURSHIP AND STARTUPS	HESU	AEC	5	CCH501	-	-	-	2	2	4	1	-	-	-	-	-			-	-	50	20	50
32	PROJECT	HPRJ	AEC	5	MEH513							1								50#	20	50	20	100
33	POWER ENGINEERING	HPER	DSC	4	MEH401	-	8	-	4	2	14	3	3	30	70	100	40	25	10	25#	10	25	10	175
34	INDUSTRIAL HYDRAULICS AND PNEUMATICS	HIHP	DSC	5	MEH507	-	8	-	4	2	14	3	3	30	70	100	40	25	10	25#	10	25	10	175
					Total	**-**	**23**		**10**	**8**	**41**	**20**		**75**	**175**	**250**		**150**		**200**		**200**		**800**
Sixth Semester																								
35	DESIGN OF MACHINE ELEMENTS	HDME	DSC	4	MEH402	-	4	-	2	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
36	INDUSTRIAL ROBOTICS AND AUTOMATION	HIRA	DSE	5	MEH503	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10			150
37	EMERGING TRENDS IN MECHANICAL ENGINEERING	HETM	DSC	5	MEH511	-	3	-	-	1	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
38	3D MODELLING AND ADDITIVE MANUFACTURING	HTMA	SEC	4	MEH414	-	-	-	4	2	6	3	-	-	-	-	-	25	10	50#	20	25	10	100
39	ELECTIVE-I (MEH504 TO MEH506)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40	ELECTIVE-II (MEH508 TO MEH510)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
					Total	**0**	**19**		**12**	**9**	**40**	**20**		**150**	**350**	**500**		**125**		**150**		**125**		**900**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
TOTAL												**120**				**2650**		**900**		**775**		**775**		**5100**
ELECTIVE- I COURSES																								
39-A	FOUNDRY TECHNOLOGY	HFTN	DSE	5	MEH504	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
39-B	TOOL ENGINEERING	HTLE	DSE	5	MEH505	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
39-C	AUTOMOBILE ENGINEERING	HAEN	DSE	5	MEH506	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
ELECTIVE- II COURSES																								
40-A	INDUSTRIAL ENGINEERING AND QUALITY CONTROL	HIEQ	DSC	5	MEH508	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40-B	WELDING TECHNOLOGY	HWTN	DSC	5	MEH509	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
40-C	REFRIGERATION AND AIR CONDITIONING	HRAC	DSC	5	MEH510	-	4	-	2	2	8	4	3.0	30	70	100	40	25	10	25#	10	25	10	175

6. EXEMPTIONS FOR COURSES

6.1 Eligibility for Exemptions for First and Second Semester Courses of MPECS-2020 for students admitted on X-pass basis

S N	Name of Course	Course Code	Whether eligible for exemption? (Yes / No)					
			XII Science	XII Tech.	XII MCVC	XII Voc.	ITI	MSCIT
1	Engineering Physics (CE/ME/MT)	CCH102	**YES**	**YES**	No	No	No	No
2	Basic Mathematics	CCH105	**YES**	**YES**	No	**YES**	No	No
3	Fundamentals of ICT	CCH202	No	No	No	No	No	**YES**

Note: The above eligibility is subject to condition that the student has secured at least 40 % marks in the respective subject.

Students seeking exemption for any other subjects should contact Academic Coordinator/ Controller of Examinations.

6.2 First year courses exempted and Credits allotted for Direct Second Year Admission

First Semester

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	BASIC MATHEMATICS	HBMT	AEC	1	CCH105	4	4	2	-	2	8	4	3	30	70	100	40	-	-	-	-	25	10	125
2	ENGINEERING CHEMISTRY- B	HCHB	DSC	1	CCH104	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
3	ENGINEERING GRAPHICS	HGRB	DSC	1	CCH106	2	2	-	4	-	6	3	4	30	70	100	40	50	20	-	-	-	-	150
4	COMMUNICATION SKILLS	HCMS	AEC	2	CCH201	0	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
5	MECHANICAL WORKSHOP PRACTICES	HMWP	SEC	1	MEH101	2	-	-	4	-	4	2		-	-	-	-	50	20	50@	20	-	-	100
6	FUNDAMENTALS OF ICT	HICT	SEC	2	CCH202	0	1	-	2	1	4	2		-	-	-	-	25	10	25@	10	25	10	75
7	YOGA AND MEDITATION	HYAM	VEC	2	CCH203	1	-	-	1	1	2	1		-	-	-	-	25	10	-	-	25	10	50
					Total	**13**	**15**	**2**	**15**	**8**	**40**	**20**		**120**	**280**	**400**		**200**		**100**		**125**		**825**
Second Semester																								
8	APPLIED MATHEMATICS	HAMT	AEC	3	CCH301	2	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100
9	ENGINEERING PHYSICS-B	HPHB	DSC	1	CCH102	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
10	ENGINEERING DRAWING (ME/MT)	HEDR	AEC	1	CCH110	4	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
11	APPLIED MECHANICS	HAPM	DSC	1	CCH108	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
12	MANUFACTURING PROCESSES	HMPR	SEC	3	MEH301	1	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
13	SOCIAL AND LIFE SKILLS	HSLS	VEC	2	CCH204	-	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
					Total	**13**	**17**	**2**	**12**	**9**	**40**	**20**		**150**	**350**	**500**		**100**		**100**		**150**		**850**

7. COURSE EQUIVALENCE FOR PREVIOUS MPECS's

SN	MPECS-1994	MPECS-2001	MPECS-2006	MPECS-2010	MPECS-2013	MPECS-2016	MPECS-2020	MPECS-2023
1	--	--	R101-Generic Skill	X101-Generic Skill	CCE201-Generic Skills	CCF201-Generic Skills	--	--
2	101-Comm. Skill	0101-Comm. Skills. - I	R102-Comm. Skills	X106-Comm. Skills	CCE202-Comm. Skills	CCF202-Comm. Skills	CCG203-Comm. Skills in English	CCH201- Communication Skills
3	102 Comm. skill –II	102 Comm. skill –II	R102 Comm. skills	X106 Comm. Skills	CCE202 Comm. Skill	CCF202 Comm. Skill	CCG203-Comm. Skills in English	CCH201- Communication Skills
4	103 Applied Physics	0103 Applied physics-I 0104 Applied physics II	R103 Applied Physics-I R104 Applied Physics II	X102 Basic Physics X108 Applied Physics	CCE101 Engineering Physics	CCF101 Engineering Physics	CCG101- Engineering Physics	CCH102- Engineering Physics
5	103 Applied Chemistry	0103 Applied Chemistry-I 0104 Applied Chemistry -II	R103 Applied Chemistry-I R104 Applied Chemistry–II	X102 Basic Chemistry X108 Applied Chemistry	CCE103 Chemistry of Engineering materials	CCF103 Chemistry of Engineering materials	CCG103- Engineering Chemistry	CCH104- Engineering Chemistry
6	105 Mathematics-I	0107 Mathematics- I	R107 Basic Mathematics	X104 Basic Mathematics	CCE105 Basic Mathematics	CCF105 Basic Mathematics	CCG105- Basic Mathematics	CCH105- Basic Mathematics
7	106 Mathematics- II	0108 Mathematics-II	R108 Engineering Mathematics	X110 Engineering Mathematics	CCE106 Engineering Mathematics	CCF106 Engineering Mathematics	CCG106- Engineering Mathematics	CCH301-Applied Mathematics
8	107 Applied Mechanics	0116 Applied Mechanics	R112 Applied Mechanics.	X111 Applied Mechanics	CCE110 Applied Mechanics	CCF110 Applied Mechanics	CCG110- Applied Mechanics	CCH108-Applied Mechanics
9	108 Introduction to Computers	0115 Introduction To Computers	R111 Computer Fundamentals & Application.	--	--	--	CCG201- Introduction to IT System	CCH202- Fundamentals of ICT
10	109 Engineering Drawing-I	0109 Engineering Drawing-I	R109 Engineering Drawing-I	X105 Engineering Drawing-I	CCE107 Engineering Drawing-1	CCF107 Engineering Drawing-1	CCG107- Engineering Drawing - 1	CCH106- Engineering Graphics
11	110 Engineering Drawing-II	0110 Engineering Drawing-II	R110 Engineering Drawing-II	X107 Engineering Drawing-II	CCE108 Engineering Drawing-2	CCF108 Engineering Drawing-2	CCG108- Engineering Drawing - 2	CCH110- Engineering Drawing
12	111 Workshop–I	0113 Workshop –I	R113 Workshop Practice-I	ME101 Basic Workshop Practice (ME)	CCE112 Workshop Practice-1	CCF112 Workshop Practice-1	CCG112 - Workshop Practice-1	MEH101- Mechanical Workshop Practices
13	112 Workshop–II	0114 Workshop -II	R114 Workshop Practice-II	ME102 Workshop Practice (ME)	CCE116-Workshop Practice-2	CCF116- Workshop Practice-2	CCG116- Workshop Practices 2	--
14	--	0111 Fundamentals of Engineering-I	--	--	MEE101 Fundamental of Mechanical Engineering	--	--	--

15	--	0112 Fundamentals of Engineering-II	--	--		--	--	--
16	M201 Mathematics-III	2201 Mathematics-III	M201 Applied Mathematics	ME201 Mathematics	MEE301 Applied Mathematics	MEF301 Applied Mathematics	MEG301- Applied Mathematics	CCH301-Applied Mathematics
17	M202 Power Engineering-I	2202 Thermal Engineering	M202 Thermal Engineering	ME202 Thermal Engineering	MEE302 Thermal Engineering	MEF302 Thermal Engineering	MEG302-Thermal Engineering	MEH302- Thermal Engineering
18	M203 Machine Drawing-I	2203 Machine Drawing	M203 Machine Drawing	ME203 Machine Drawing	MEE303 Machine Drawing	MEF303 Machine Drawing	MEG303-Machine Drawing	MEH303- Production Drawing
19	M204-Manufacturing Process-I	2204- Manufacturing Processes	M204- Manufacturing Processes	ME204-Manufacturing Processes	MEE304 - Manufacturing Processes	MEF304-Manufacturing Processes	MEG304-Manufacturing Processes	MEH301-Manufacturing Processes
20	M205 Strength of Materials	2205 Theory of Engineering Design	M205 Theory of Engineering Design	ME205 Theory of Engineering Design	MEE305 Theory of Engineering Design	MEF305 Theory of Engineering Design	MEG305- Strength of Materials	MEH305- Mechanics of Materials
21	M206 Machine Tools -I	2206 Machine Tools	M206 Production Processes.	ME206 Production Processes.	MEE306 Machine Tools	MEF306 Machine Tools	MEG306-Machine Tools	--
22	M207 Machine Drawing- II	2207 Production Drawing	--	--	--	--	--	--
23	M208 Mechanisms	2208 Mechanisms	M208 Theory of Machines & Mechanisms.	ME208 Theory of Machines & Mechanisms.	MEE308 Theory of Machines & Mechanisms.	MEF308 Theory of Machines & Mechanisms.	MEG308-Theory of Machines	MEH308- Theory of Machines
24	--	2209 Electrical Technology	M209 Electrical Technology	ME209 Electrical Technology	MEE309 Electrical Technology	MEF309 Electrical Technology	--	--
25	M209 Engineering Materials	2211 Engineering Materials	--	--	--	--	--	--
26	M210 Heat Transfer	2212 Heat Transfer	--	--	--	--	--	--
27	M211 Engineering Metallurgy	2213 Engineering Metallurgy	M210 Engg. Materials & Metallurgy	ME210 Engg Materials & Metallurgy	MEE310 Engg. Metallurgy and Materials	MEF310 Engg. Metallurgy and Materials	MEG310- Engg. Metallurgy and Materials	MEH310-Engineering Metallurgy
28	--	--	M207 Applied Electronics.	ME207 Applied Electronics.	MEE307Applied Electronics	MEF307 Applied Electronics	--	--
29	--	--	M211 Personality Development.	ME211 Personality Development.	CCE203 Professional Practices	CCF203 Professional Practices	--	--
30	221 Basic Civil Engg.	0221 Elements of Civil Engg.	R221 Elements of Civil Engg.	--	--	--	--	--
31	222 Basic Electrical Engg.	0222 Electrical Circuits & Machines.	R222 Electrical Circuits & Machines.	--	--	--	--	--
32	223 Basic Electronics.	0223 Basic Electronics.	R223 Basic Electronics.	--	--	--	--	--

33	224 Basic Mechanical Engg.	0224 Basic Mechanical Engg.	R224 Basic Mechanical Engg.	--	MEE101 Fundamental of Mechanical Engg	--	--	--
34	225 Basic Sugar Manufacturing	0225 Basic Sugar Manufacturing	R225 Basic Sugar Manufacturing	--	--	--	--	--
35	226 Pollution Control	0226 Pollution Control	R226 Pollution Control	ME212 Pollution Control	MEE311Pollution Control	MEF311 Pollution Control	--	--
36	227 Non Conventional energy sources.	0227 Non-Conventional Energy Sources.	R227 Non-Conventional energy Sources.	ME213 Non-Conventional energy Sources.	MEE312 Non-Conventional Energy Sources	MEF312 Non-Conventional Energy Sources	--	--
37	228 Higher Mathematics	0228 Higher Mathematics	R228 Higher Mathematics	ME214 Higher Mathematics	MEE313 Higher Mathematics	MEF313 Higher Mathematics	--	--
38	M301 Power Engineering-II	2301Power Engineering	M301Power Engineering	ME301Power Engineering	MEE401 Power Engineering	MEF401 Power Engineering	MEG401- Power Engineering	MEH401-Power Engineering
39	M302 Machine Design	2302 Machine Design	M302 Machine Design	ME302 Machine Design	MEE402 Machine Design	MEF402 Machine Design	MEG402-Machine Design	MEH402-Design of Machine Elements
40	M303 Machine Tools –II	2305CNC Machine Tools	M303Advance Machining Processes.	ME303Advance Machining Processes.	MEE403 Advanced Machining Processes	MEF403 Advanced Machining Processes	MEG403- Advanced Machining Processes	MEH317-Advanced Machining Processes
41	M304 Project Work & Seminar	--	M304 Seminar	ME304 Seminar	MEE404 Project-I	MEF404 Project- I	MEG404- Project- 1	MEH513-Project
42	--	304 Industrial Project	M305 Project	ME305 Project	MEE405 Project- II	MEF405 Project- II	MEG405- Project- 2	MEH513-Project
43	M305 Plant Maintenance Engineering	2306 Plant Maintenance Engineering	--	--	--	--	--	--
44	M 306 Hydraulic Machinery	2307 Hydraulic Machinery	M306Hydraulic Machinery	ME306 Hydraulic Machinery	MEE406 Hydraulic Machinery	MEF406 Hydraulic Machinery	MEG406- Fluid Mechanics and Machinery	MEH306-Fluid Mechanics and Machinery
45	M 307 Metrology and Quality control	2308 Metrology 2309 Quality Control	M307 Metrology M404 Quality Management	ME307 Metrology ME404 Quality Management	MEE407 Metrology MEE503 Quality Management	MEF407 Metrology MEF503 Quality Management	MEG314- Engineering Metrology MEG418- Total Quality Mgmt.	MEH314- Engineering Metrology and Measurement MEH508- Industrial Engineering and Quality Control
46	M 308 Advance Machine Tools	2303 Advance Machine Tools	M303 Advanced Machining Processes	ME303 Advanced Machining Processes	MEE403 Advanced Machining Processes	MEF403 Advanced Machining Processes	MEG403- Advanced Machining Processes	MEH317-Advanced Machining Processes
47	M 309 Instrumentation	2310 Instrumentation	--	--	--	--	--	--

48	--	--	M309 Mechanical Measurement & Mechatronics.	ME309 Mechanical Measurement & Mechatronics.	MEE410 Mech. Measurement & Mechatronics	MEF410 Mech. Measurement & Mechatronics	MEG316- Mechanical Engineering Measurements MEG415- Mechatronics and Robotics	MEH314- Engineering Metrology and Measurements MEH318- Basics of Mechatronics
49	--	--	M310 Marketing Management	ME310 Marketing Management	MEE411 Marketing Management	MEF411 Marketing Management	MEG416- Marketing Management	--
50	--	--	M311 Alternative Energy Sources.	ME311Alternative Energy Sources.	MEE312 Non-Conventional Energy Sources	MEF312 Non-Conventional Energy Sources	--	--
51	M401 Computer Programming	2401 Computer Programming	M401 Computer Programming	ME401 Computer Programming	MEE408 Computer Programming	MEF408 Computer Programming	--	--
52	M402 Computer Application	2402 Computer Application	M402 Computer Application	ME402 Computer Application	MEE409 Computer Application	MEF409 Computer Application	MEG315- Computer Aided Drafting MEG414- Solid Modeling	MEH315-Computer Aided Drafting MEH414- 3D Modelling and Additive Manufacturing
53	M403 Ind. Org. And Management	2403 Ind. Org. And Management	M403 Ind. Org. And Management	ME403 Ind. Org. And Management	MEE50 Industrial Org. And Mgmt.	MEF502 Industrial Org. And Mgmt.	MEG501- Industrial Org. And Mgmt.	CCH502-Industrial Organization and Management
54	M404 Entrepreneurship	2404 Entrepreneurship	M308 Career & Entrepreneurship Development	ME308 Career & Entrepreneurship Development	MEE501 Entrepreneurship Development	MEF501 Entrepreneurship Development	CCG501- Entrepreneurship Development	CCH501- Entrepreneurship Development and Startups
55	M405 Production Engineering	2405 Production Engineering	--	--	--	--	--	--
56	M 406 Industrial Engineering	2406 Industrial Engineering	M405 Industrial Engineering	ME405 Industrial Engineering	MEE504 Industrial Engineering	MEF504 Industrial Engineering	MEG503- Industrial Engineering	MEH508-Industrial Engineering and Quality Control
57	M407 Material Management	2407 Material Management	M407 Material Management	ME407 Material Management	MEE506 Material Handling System	--	--	--
58	M408 Foundry Technology	2408 Foundry Technology	M408 Foundry Technology	ME408 Foundry Technology	MEE507 Foundry Technology	MEF507 Foundry Technology	MEG504- Foundry Technology	MEH504- Foundry Technology
59	M409 Refrigeration and Air Conditioning	2409 Refrigeration and Air Conditioning	M409 Refrigeration and Air Conditioning	ME409 Refrigeration and Air Conditioning	MEE508 Refrigeration & Air Conditioning	MEF508 Refrigeration &Air Conditioning	MEG505- Refrigeration & air conditioning	MEH510- Refrigeration and Air Conditioning

60	M 410 Automobile Engg.	2410 Automobile Engg.	M410 Automobile Engg.	ME410 Automobile Engg.	MEE509 Automobile Engineering	MEF509 Automobile Engineering	MEG506- Automobile Engineering	MEH506- Automobile Engineering
61	M 411 Industrial Safety	2412 Industrial Safety	--	--	--	--	--	--
62	M413 Estimation and Costing	2413 Estimation and Costing	--	--	--	--	--	--
63	--	2411 Industrial Hydraulics & Pneumatics.	M411 Industrial Hydraulics & Pneumatics.	ME411 Industrial Hydraulics & Pneumatics.	MEE510 Industrial Hydraulics & Pneumatic	MEF510 Industrial Hydraulics &Pneumatic	MEG507- Industrial Hydraulics & Pneumatics	MEH507-Industrial Hydraulics and Pneumatics
64	--	--	M404 Quality Management	ME404 Quality Management	MEE503 Quality Management	MEF503 Quality Management	MEG418- Total Quality Mgmt.	MEH508-Industrial Engineering and Quality Control
65	--	--	M406 Quality Systems	ME406 Quality Systems	MEE412 Quality Systems	MEF412 Quality Systems	--	--
66	--	--	M412 Tool Engineering	ME412 Tool Engineering	MEE511 Tool Engineering	MEF511 Tool Engineering	MEG508- Tool Engineering	MEH505-Tool Engineering
67	--	--	M413 Welding Technology	ME413 Welding Technology	MEE512 Welding Technology	MEF512 Welding Technology	MEG509 Welding Technology	MEH509-Welding Technology
68							MEG417-Emerging Trends in Mechanical Engineering	MEH511- Emerging Trends in Mechanical Engineering
69							CCG117-Sports and Yoga	CCH203- Yoga and Meditation
70							MEG309- Basic Electrical and Electronics Engg.	MEH309- Basic Electrical and Electronics
71							CCG205- Essence of Indian Traditional Knowledge	--
72							CCG502- Internship 1 (4 weeks)	CCH505- Internship (16 Weeks)
73							CCG503-Internship 2 (3 weeks)	CCH505- Internship (16 Weeks)
74							CCG206- Indian Constitution	CCH205-Essence of Indian Constitution
75							--	MEH320- Fundamentals of Python Programming
76							--	CCH204- Social and Life Skills

77							--	MEH503-Industrial Robotics and Automation
78							CCG204-Environmental Science	CCH206-Environmental Education and Sustainability
79							EEG301-Mechanical and Civil Engineering	EEH302-Basic Mechanical and Civil Engineering

8. PROFORMAS FOR EVALUATION OF TERM WORK, ORALS AND PRACTICALS

GOVERNMENT POLYTECHNIC KOLHAPUR

PROFORMA -I **(MPECS 2023)**

Continuous Assessment/ Tutorial /Self Learning Activity Assessment

By Internal Examiner

PR/TU/Assignment No.		1	2	3	4	5	6	7	8	9	10	Total Marks out of ( )	Marks converted as per scheme ( )
Sr. No	Roll No.												

Internal Examiner
Name & Sign

Government Polytechnic Kolhapur

PROFORMA II (MPECS 2023)

Used for Summative Assessment Practical /Oral Examination by Internal Examiner

Sr. No.	Roll No.	Knowledge about the course$	Preparedness for practical	Neat & complete Diagram/write up	Communication /Presentation	Performance in practical Exam.	Total out of 25	Converted Marks as per Learning scheme ( )
		5M	5M	5M	5M	5M		

Internal Examiner Name & Sign

Government Polytechnic Kolhapur
PROFORMA III (MPECS 2023)
Used for Summative Assessment Practical /Oral Examination
By Internal Examiner & External Examiner

Sr. No.	Roll No.	Internal Examiner Marks (25) (From proforma II)	External Examiner Marks (25)	Total Marks (50)	Converted Marks as per Learning scheme ( )

Internal Examiner
Name & Sign

External
Examiner
Name & Sign

SEMESTER 1ST SCHEME AND CURRICULUM

GOVERNMENT POLYTECHNIC KOLHAPUR			
Learning and Assessment Scheme for Post S.S.C Diploma Courses			
Programme Name	**: Diploma In Mechanical Engineering**		
Programme Code	**: ME**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 15 WEEKS**
Semester	**: First**	**Scheme**	**: MPECS 2023**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	BASIC MATHEMATICS	HBMT	AEC	1	CCH105	4	4	2	-	2	8	4	3	30	70	100	40	-	-	-	-	25	10	125
2	ENGINEERING CHEMISTRY- B	HCHB	DSC	1	CCH104	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
3	ENGINEERING GRAPHICS	HGRB	DSC	1	CCH106	2	2	-	4	-	6	3	4	30	70	100	40	50	20	-	-	-	-	150
4	COMMUNICATION SKILLS	HCMS	AEC	2	CCH201	0	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
5	MECHANICAL WORKSHOP PRACTICES	HMWP	SEC	1	MEH101	2	-	-	4	-	4	2		-	-	-	-	50	20	50@	20	-	-	100
6	FUNDAMENTALS OF ICT	HICT	SEC	2	CCH202	0	1	-	2	1	4	2		-	-	-	-	25	10	25@	10	25	10	75
7	YOGA AND MEDITATION	HYAM	VEC	2	CCH203	1	-	-	1	1	2	1		-	-	-	-	25	10	-	-	25	10	50
Total						**13**	**15**	**2**	**15**	**8**	**40**	**20**		**120**	**280**	**400**		**200**		**100**		**125**		**825**

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprentice. /Project. /Community (INP): 0, Ability Enhancement Course (AEC): 2, Skill Enhancement Course (SEC): 2, Generic Elective (GE): 0

COURSE ID : ME
COURSE NAME : BASIC MATHEMATICS
COURSE CODE : CCH105
COURSE ABBREVIATION: HBMT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	02	
	Laboratory Learning	-	
	SLH-Self Learning	02	
	NLH-Notional Learning	**08**	

B: ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Tutorial						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40			--	--	25	10	125

(Total IKS Hrs. for Sem.: 06 Hrs.)

C: ABBREVIATIONS: -

CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment
Legends: @Internal Assessment, #External Assessment, *#OnLine Examination, @$InternalOnlineExamination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.
   *Self learning includes micro project /assignment/other activities. (The list of all assignments are given in tabular format. At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Mathematics is an important prerequisite for the development and understanding of engineering and technological concepts. For an engineer and technologist, knowledge of mathematics is an effective tool to pursue and master the applications in the engineering and technological fields. Algebra provides the language and abstract symbols of mathematics. The topic Matrices is helpful for finding optimum solution of system of simultaneous equations which are formed in the various branches of engineering using different parameters. Trigonometry is the study of triangles and angles. Contents of this subject will form foundation for further study in mathematics. Statistics can be defined as a type of mathematical analysis which involves the method of collection and analyzing the data and summing of the data in numerical form for a given set of real world observations. Calculus is a branch of mathematics that calculates how matter, particles and heavenly bodies actually move. Derivatives are useful to find maxima & minima of a function, velocity & acceleration are also useful for many engineering problems. Hence the course provides the insight to analyze engineering problems scientifically using logarithms, matrices, trigonometry, straight line, differential calculus and statistics.

ii) Competency:

Apply principles of Basic Mathematics to solve industry-based technology problems.

1.Cognitive : To understand the mathematical concepts
2. Psychomotor: Proper handling of scientific calculator
3. Affective : Attitude of accuracy, punctuality, proper reasoning and presentation

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH105-1 : To Apply concepts of algebra to solve engineering related problems
CCH105-2 : To Use techniques and methods of statistics to compare multiple sets of data
CCH105-3 : Solve area specific engineering problems under given conditions of straight lines
CCH105-4:- To memorize trigonometric formulae and solve problems based on them.
CCH105-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency:	3	2	1	-	1	-	2		
CCH105-1	3	1	-	-	-	-	1		
CCH105-2	3	1	-	-	1	-	1		
CCH105-3	3	-	-	-	-	-	1		
CCH105-4	3	1	1	-	-	-	1		
CCH105-5	3	2	1	-	1	-	1		

F. CONTENT:

i) Tutorial exercises

Any **TEN** of the following Tutorial exercises shall be conducted in the Tutorial room in tutorial sessions of batches of about 20- 22 students:

Sr. no	Tutorial experiences	CO
1	Solve Simple problems of Logarithms based on given application	CCH105-1
2	Solve elementary problems on Algebra of Matrices	CCH105-1
3	Solve simultaneous equations using Matrix inversion method	CCH105-1
4	Resolve into Partial Fractions using linear non repeated, repeated and irreducible quadratic factors	CCH105-1
5	Practice problems on equation of straight lines using different forms, Solve problems on perpendicular distance, distance between two parallel lines and angle between two lines	CCH105-3
6	Solve problems on finding range, coefficient of range and mean deviation	CCH105-2
7	Solve problems on Standard deviation, coefficient of variation and comparison of two sets	CCH105-2
8	Solve problems on Allied & Compound angles	CCH105-4
9	Solve problems on Multiple & sub multiple angles	CCH105-4
10	Solve problems on factorization & De- factorization formulae	CCH105-4
11	Solve problems on Inverse Trigonometric Functions	CCH105-4
12	Solve examples on functions & rules of derivatives	CCH105-5
13	Solve examples on Derivative of composite function, inverse & parametric functions,	CCH105-5
14	Solve examples on Derivative of exponential, implicit and logarithmic functions	CCH105-5
15	Solve examples on Application of Derivatives	CCH105-5

II)Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH105-1: To Apply concepts of algebra to solve engineering related problems			
Unit 1 Algebra	***1.1 LOGARITHMS*** 1.1.1 Concept and laws of logarithm 1.1.2 Simple examples based on laws of Logarithms ***1.2 MATRICES*** 1.2.1 Definition of a matrix, Types of matrices, Algebra of matrices, Equality of two matrices, Transpose of a matrix, 1.2.3 Adjoint and Inverse of a matrix 1.2.4 Solution of simultaneous equations having 3 unknowns using Matrix inversion method ***1.3 PARTIAL FRACTIONS*** 1.3.1 Definition of rational, proper and improper fractions 1.3.2 Various cases of Partial fractions and Examples 1.4 Algebra of Indian Knowledge System: Solution of simultaneous equations using Vedic Mathematics	12	16
CO: CCH105-2: To Use techniques and methods of statistics to compare multiple sets of data			
Unit 2 Statistics	***MEASURES OF DISPERSION*** 2.1 Range, Coefficient of Range of Discrete and grouped data 2.2 Mean deviation and Standard Deviation about mean for Discrete & Grouped Data (except Assumed mean method and Step deviation method) 2.3 Variance and coefficient of Variance 2.4 Comparison of 2 sets of observations	6	10
CO: CCH105-3 : Solve area specific engineering problems under given conditions of straight lines			
Unit 3 Coordinate Geometry	***THE STRAIGHT LINE*** 3.1 Slope, intercepts & various methods of finding slope 3.2 Conditions for two straight lines to be parallel and Perpendicular to each other 3.3 Various forms of straight line 3.4 Perpendicular distance of a point from a line 3.5 Distance between two parallel lines 3.6 Angle between two straight lines 3.7 Geometry in Sulabh sutras in Indian Knowledge System	6	8

Section –II

Sr. no.	**Topics/Subtopics**	Learning Hours	Classroom learning evaluation Marks
CO: CCH105-4:- To memorize trigonometric formulae and solve problems based on them.			
Unit 4 Trigonometry	***TRIGONOMETRY*** 4.1 Fundamental Identities (Only state, No examples) 4.2 Conversion of degree into radian and vice versa of standard angles 4.3 Trigonometric ratios of Compound Angles (Without Proof), Examples 4.4 Trigonometric ratios of Allied Angles (Without Proof), Examples 4.5 Trigonometric ratios of Multiple and Submultiple Angles (Without Proof), Examples 4.6 Factorization and De-Factorization Formulae (Without Proof) , Examples 4.7 Inverse Trigonometric ratios, Principle values and simple problems 4.8 Trigonometry in Indian Knowledge System: The evolution of sine function in India 4.9 Trigonometry in Indian Knowledge System: Indian Trigonometry-From ancient beginning to Nilakantha 4.10 Trigonometry in Indian Knowledge System: Ancient Indian Astronomy 4.11 Trigonometry in Indian Knowledge System: Pythagorean to triples in Sulabhsutras	14	14
CO: CCH105-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.			
Unit 5 Differential Calculus	5.1 **Functions**: Concept of Functions and simple examples 5.2 **Limits**: Concept of Limits without examples 5.3 **Derivatives:** 5.3.1 Derivative of sum, difference, product and quotient of two or more functions 5.3.2 Derivative of composite functions 5.3.3 Derivative of Inverse functions 5.3.4 Derivative of Implicit functions 5.3.5 Derivative of Parametric functions 5.3.6 Derivative of exponential and logarithmic functions 5.3.7 Calculus in Indian Knowledge system " Discovery of Calculus by Indian Astronomers (Indian Mathematics)	16	16

CO: CCH105-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.			
Unit 6 Application of Derivatives	***APPLICATIONS OF DERIVATIVES*** 6.1 Second Order Derivatives (without examples) 6.2 Equation of Tangent & Normal 6.3 Maxima & Minima (only for algebraic functions) 6.4 Radius of curvature	06	06

** No questions will be asked on IKS related subtopics in any question paper

G: LIST OF MICROPROJECT /ASSIGNMENTS UNDER SLA

Sr. No	List of Assignment (under SLA)	Hrs Allotted
1	Collect the Data of Marks obtained by your class in mid semester test. Compute the variance and coefficient of variance of the data	-
2	Prepare a model using the concept of tangent and normal, bending of curves in case of sliding of a vehicle.	-
3	Prepare charts of grouped and ungrouped data.	-
4	Collect statistical data on real world problems and find Mean Deviation & S.D.	-
5	Collect at least 10 examples based on real world applications which will be used to find S.D. /Variance.	-
6	Prepare models to explain different concepts.	-
7	Prepare a model using concept of radius of curvature of bending of railway tracks.	-
8	A window in the form of rectangle surmounted by a semicircular opening. The total perimeter the window to admit maximum light through the whole opening, prepare a model using concept of Maxima & Minima for the above problem and verify the result.	-
9	Collect applications of radius of curvature on lens design and optics, mirror and reflective surface properties, road and highway design, structural behavior, roller coaster track design & make a video of 5- minutes duration.	-
10	Design a puzzle based on matrices. Create a grid of numbers and operations.	-
11	Develop a math game based on operations of matrices.	-
12	Collect examples based on real world applications of logarithm and prepare a pdf file.	-
13	Measure height of trees/buildings in surrounding locations using trigonometry and prepare presentation.	-
14	Apply trigonometric principles to calculate angles, distances, dimensions relevant to the chosen area and make a poster presentation.	-
15	Find height of room or distance between two pillars by using concept of straight line.	-

****Attempt any 10-12 Micro Projects, out of the given list.**

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Algebra	4	6	6	16	CCH105-1
I / 2	Statistics	2	4	4	10	CCH105-2
I / 3	Coordinate Geometry	2	2	4	8	CCH105-3
II /4	Trigonometry	2	6	6	14	CCH105-4
II /5	Differential Calculus	2	6	8	16	CCH105-5
II/6	Application of Derivatives	2	2	2	6	CCH105-5
	Total Marks				70	

I): -ASSESSMENT CRITERIA

Formative Assessment of Tutorial: -

Every Tutorial shall be assessed for 25 marks as per following criteria:

Sr No	Particulars	Marks out of 25
1	Understanding	05
2	Application	05
3	Solving skill	05
4	Remembering formulae & Accuracy	05
5	Discipline and punctuality	05
	TOTAL	25

J) INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Classroom practices.
3. Use of projector and soft material for demonstration
4. Use of internet.
5. WhatsApp groups.
6. Use of books

K) TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) REFERENCE BOOKS:

S. N.	Name of Book	Author	Publication
1	A Text Book on Engineering Mathematics (First Year Diploma)	G. V. Kumbhojkar	Phadake Prakashan, Kolhapur
2	Basic Mathematics	Patel, Rawal and others	Nirali Prakashan, Pune
3	Basic Mathematics	Sachin S. Shah & Santosh R. Mitkari	Tech-Neo Publications
4	Basic Mathematics	Vitthal B.Shinde & others	Techical Publications
5	Higher Engineering Mathematics	Grewal B.S.	Khanna publication New Delhi,2013 ISBN:8174091955
6	A text book of Engineering Mathematics	Dutta D.	New age publication New Delhi,2006 ISBN:978-81-224-1689-3
7	Studies in the History of Indian Mathematics	C. S. Seshadri	Hindustan Book Agency,New Delhi 110016.ISBN 978-93-80250-06-9
8	Indian Mathematics Engaging with the World from Ancient to Modern Times	George Gheverghese Joseph	World Scientific Publishing Europe Ltd.57 ASBN 978-17-86340-61-0
9	Calculus and Its Applications	Marvin L.Bittinger David J.Ellenbogen Scott A.Surgent	Addison-Wealey 10th Edition ISBN-13:978-0-321-69433-1
10	Mathematics- I	Deepak Singh	Khanna Book Publishing Co. (P) Ltd. ISBN:978-93-91505-42-4
11	Mathematics -II	Garima Singh	Khanna Book Publishing Co. (P) Ltd. ISBN:978-93-91505-52-3
12	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN:9788121903455
13	Sansar ke Mahan Ganitagya	Gunakar Muley	Raj kamal Prakashan ISBN-13. 978-8126703579
14	An Introduction to Statistical learning with applications in R	Gareth James & others	Springer New York Heidelberg Dordrecht London ISBN:978-1-4614-7137-0

M) LEARNING WEBSITE & SOFTWARE

1. www.nptel.ac.in/courses/106102064/1
2. www.scilab.org/-SCI Lab
3. www.mathworks.com/product/matlab/-MATLAB
4. Spreadsheet Applications
5. http://ocw.abu.edu.ng/courses/mathematics/
6. https://ocw.mit.edu/
7. https://libguides.cmich.edu/OER/mathematics
8. https://libguides.furman.edu/oer/subject/mathematics

*****

COURSE ID : ME
COURSE NAME : ENGINEERING CHEMISTRY
COURSE CODE : CCH 104
COURSE ABBREVIATION : HCHB

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
1.5	30 *#	70*#	100	40	25	10	25 @	10	25	10	175

(Total IKS Hrs for Sem.: 04 Hrs)

C: ABBREVIATIONS: -

CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Basic science such as Chemistry is the fundamental of Engineering & technology. It is most essential to learn the basic science to understand the fundamental concepts in Engineering & technology. Engineering chemistry deals with the study of structure, composition & properties of the materials, which form the core of the fundamental science. Many processes are based on principle of Chemistry in various industries. Topics such as Water, Electrochemistry, Corrosion, & protection of metals from corrosion are some of the direct applications of chemistry in engineering. Hence, the knowledge of chemistry is essential to the aspiring engineers of all branches in their field. Engineering materials like Steel, Rubber, Plastic, Thermocole, Glass wool, Paints, Lubricants are the backbone of various industries, machines, equipment & processes.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply principles of advanced chemistry to solve engineering problems.

Cognitive: Understanding concepts of chemistry for applications in the area of engineering.

Psychomotor: Sketching and labeling the diagrams for extraction of copper

i) Experimentally analyzing the water samples for preparing portable water by different methods.

ii) Preparing chart of showing percentage, composition, properties and industrial applications of solders.

iii)Handling & use of glassware & chemicals.

Affective: i) Accuracy ii) Safety iii) Punctuality iv. Attitude.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH104-1 Apply the basic knowledge of atom, molecules and compounds in Engineering Chemistry.

CCH104-2 Apply the concepts of Electrochemistry to interpret the reasons of corrosion with its remedies.

CCH104-3 Select the relevant catalyst, alloys, insulators, adhesives, composite materials, plastic and rubber for different applications in the field of engineering.

CCH104-4 Use of water in Domestic purpose, Industrial purpose and its relevant treatment to solve industrial problems.

CCH104-5 Explain the method of Extraction of Iron.

CCH104-6 Choose appropriate with relevant method of lubrication to solve industrial problem and applications of Paint and Varnish.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / velopmer solution	PO 4 gineerin Tools, periment ion and Testing	PO 5 ngineering ractices fo society, stainabilit and vironmen	PO 6 Project nagem t	PO 7 ife-long earning	PSO1 Work in mfg& service sector	PSO 2 Start entreprene urial activity
CCH104-1	3	2	-	1	3	1	3	1	1
CCH104 -2	3	2	-	1	2	1	3	-	-
CCH104 -3	3	1	-	-	2	1	3	-	-
CCH104 –4	3	2	-	1	3	1	3	-	-
CCH104-5	3	1	-	-	2	1	3	-	-
CCH10- 6	3	2	-	1	2	1	3	-	-

F. CONTENT:

i) PRACTICAL EXERCISES

The following practical exercises shall be conducted in the *Laboratory for Engineering Chemistry developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	CO
1	Introduction to Chemistry laboratory	CCH104-1
2	Volumetric analysis of solution.	CCH104-1
3	Preparation of 1 N, 0.5 N & 0.1 N Solutions of different chemicals like NaOH, HCI, Oxalic acid, $FeSO_4$, etc.	CCH104-1
4	Titration of strong acid and strong bases (HCl X NaOH)	CCH104-1
5	Double titration of strong acid, strong base & weak acid (HCI X NaOH X $H_2C_2O_4.H_2O$)	CCH103-1
6	Titration of weak base, strong acid & strong base (Na_2CO_3 X H_2SO_4 X KOH)	CCH103-1
7	Estimation of chloride content in water by Mohr' s method	CCH103-4
8	Determination of amount of Ca and Mg ions present in given sample of water by E.D.T.A method	CCH103-4
9	Estimation of viscosity of oils/solutions by Ostwald's method	CCH103-6
10	Estimation of Ca in limestone.	CCH103-5
11	Titration of $KMnO_4$ & $FeSO_4$ (Redox titration)	CCH103-5
12	Estimation of % of Fe in given sample of steel.	CCH103-3
13	Determination of alkalinity of water.	CCH103-4
14	Determination of Electrochemical equivalent (ECE) by copper volt meter.	CCH104-2
15	To estimate volumetrically the percentage of copper in a given sample of Brass.	CCH104- 5

Sr. no	Laboratory experiences	CO
16	To demonstrate the different types of Solders.	CCH104-3

ii. THEORY

SECTION I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO - CCH104-1 Apply the basic knowledge of atom, molecules and compounds in Engineering Chemistry.			
1	**ATOMIC STRUCTURE AND CHEMICAL BONDING** 1.1 Philosophy of atom by Acharya Kanad. 1.2 Atom, Fundamental particles, Nature of atom. 1.3 Atomic Number, Mass Number, Isotopes and isobars. 1.4 Bohr's theory of atom. 1.5 Statement of Aufbau's principle, Hund's rule of maximum multiplicity, Pauli's exclusion principle. 1.6 Lewis and Langmuir's concept of stable electronic configuration. 1.7 Electrovalency and Co-valency. 1.8 Formation Of electrovalent compounds- NaCl, $CaCl_2$. 1.9 Formation of Covalent compounds- H_2O, CO_2,	**07**	**08**
CO - CCH104-2 Apply the concepts of Electrochemistry to interpret the reasons of corrosion with its remedies.			
2	**ELECTROCHEMISTRY AND CORROSION.** 2.1Definitions- Cathode, Anode, Conductor, Electrolyte, Electrode, Ionisation, Electrolysis. 2.2 Arrhenius Theory of Ionisation. 2.3 Degree of Ionisation & Factors affecting degree of ionisation. 2.4 Statement of Faraday's first and second law of electrolysis. 2.5 Relation between CE and ECE. 2.6 Electrolysis of molten NaCl. 2.7 Electrolysis of CuSO4 solution by using Cu-Electrodes. 2.8 Industrial applications of electrolysis. 2.8.1 Electroplating. 2.8.2 Electro refining of Cu. 2.9 Definition & types of corrosion. 2.10 Dry or Atmospheric corrosion, Oxide Film Formation & its types, Factors affecting atmospheric corrosion. 2.11Wet or electrochemical corrosion 2.12 Factors influencing immersed corrosion 2.13 Methods of protection of metal from corrosion -	**10**	**10**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Hot dipping (Galvanizing & Tinning), Metal spraying, Metal cladding, Cementation or sherardizing.		
CO - CCH104-3 Select the relevant catalyst, alloys, insulators, adhesives, composite materials, plastic and rubber for different applications in the field of engineering.			
3	**CHEMISTRY OF ENGINEERING MATERIALS AND CATALYSIS.** **3.1 INSULATORS** 3.1.1 Definition & Characteristics of insulator. 3.1.2 Preparation, properties & uses of Glass wool, Thermocole. **3.2 COMPOSITE MATERIALS** 3.2.1 Definition. 3.2.2 Classification, Properties & Application of composite materials. **3.3 PLASTICS** 3.3.1Definition of Polymer, Polymerization. 3.3.2Types of polymerization – Addition & Condensation polymerization. 3.3.3Classification of plastic - Thermosoftening & Thermosetting plastic. 3.3.4 Engineering properties & applications of plastic. **3.4 RUBBER** 3.4.1 Elastomer 3.4.2 Drawbacks of Natural rubber. 3.4.3 Vulcanization of rubber. 3.4.4 Engineering properties & uses of rubber. **3.5 ADHESIVES** 3.5.1 Definition of adhesives. 3.5.2 Characteristics of good adhesive. 3.5.3 Properties of adhesive. **3.6 CATALYSIS** 3.6.1 Definition. 3.6.2 Types of Catalyst with example. - Positive catalyst - Negative catalyst 3.6.3 Types of Catalysis. - Homogeneous catalysis. - Heterogeneous catalysis	**13**	**16**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.6.4 Catalytic Promoters. 3.6.4 Catalytic Inhibitors 3.6.5 Autocatalysis.		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO - CCH104-4 Use of water in Domestic purpose, Industrial purpose and its relevant treatment to solve industrial problems.			
4	**WATER** 4.1 Impurities in natural water. 4.2 Hard water & Soft water. 4.3 Hardness of water- Temporary & Permanent. 4.4 Reactions of hard water with soap. 4.5 Disadvantages of hard water for domestic & Industrial purpose - Textile Industry, Sugar Industry, Paper Industry Dying Industry. 4.6 Sterilization of water - Chlorination –by Cl_2, bleaching powder, Chloramines with chemical reactions. 4.7 Ion Exchange method to remove total hardness of Water.	**09**	**12**
CO - CCH104-5 Explain the method of Extraction of Iron.			
5	**METALLURGY AND ALLOYS** 5.1 Occurrence of metals, Definition of minerals, Ore, Flux, Gangue & Slag. 5.2 Flow chart of metallurgical processes. 5.3 Concentration of ores – Physical methods – 1. Gravity separation method 2. Electromagnetic separation method 3. Froth floatation method Chemical methods – 1. Calcination 2. Roasting 5.4 Ores of Iron.	**12**	**14**

	5.5 Extraction of Iron from its ore – Blast furnace – Construction, working, reactions & Products. 5.6 Definition of alloys. 5.7 Classification & purposes of making of alloys. 5.8 Composition, properties & engineering application of – **Non- ferrous alloys** – Duralumin, Monal metal & Woods metal. **Ferrous alloys** – Heat resisting steel, magnetic steel, Stainless steel.		
CO - CCH104-6 Choose appropriate with relevant method of lubrication to solve industrial problem and applications of Paint and Varnish.			
6	**LUBRICANTS, PAINT AND VARNISH** 6.1.1 Definition, Classification & Functions of lubricants. 6.1.2 Characteristics of lubricants – Viscosity, Viscosity index, Oiliness, Volatility, Cloud point & Pour point, Flash & Fire point, Acid value. 6.2 Oil paint – Definition & characteristics of oil paint. 6.3 Purpose of using oil paint. 6.4 Ingredients of oil paint with suitable example & its functions – Drying oil (Vehicle), Drier, Pigment, Thinner, Filler (Extenders), Plasticizer. 6.5 Varnish – Definition, types, constituents, Properties & applications. 6.6 Distinction between paint & varnish.	**09**	**10**

** No questions will be asked on IKS learning subtopics in any question papers.

G : LIST O F ASSIGNMENTS UNDER SLA

Sr. No	List of Assignment (under SLA) (Any one of the following)	Hrs. Allotted
1	Prepare distinguish chart for Isotopes & Isobars, Electrovalent & Covalent bond	02
2	Prepare Charts of Bohr's Theory, Lewis & Langmuir's theory.	02
3	Faraday's First & Second law statements & formula.	02
4	Electroplating & Electrorefining with diagram	02
5	Note on corrosion due to Oxygen & its types	02
6	With neat labelled diagram explain the process of 1. Galvanizing, 2. Tinning, 3. Metal spraying, 4. Metal Cladding, 5. Sherardizing	02
7	Properties of Plastics, rubber, insulator, composite materials & adhesives.	02
8	Uses/Applications of Plastics, rubber, insulator, composite materials & adhesives.	02

9	Draw diagram of Ion Exchange method	02
10	Note on Impurities present in Natural Water.	02
11	Disadvantages of hard water in Domestic purposes	02
12	Disadvantages of hard water in Industrial purposes	02
13	Flow chart of Metallurgical processes	02
14	With neat labelled diagram explain 1. Gravity separation method. 2. Electromagnetic separation method. 3. Froth floatation method.	02
15	Explain ingredients present in Paints	02

**** From the above any two assignments to be completed by the students.**

H : SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Atomic Structure and Chemical Bonding	4	2	2	08	CCH104-1
I / 2	Electrochemistry & Corrosion	4	4	2	10	CCH104-2
I / 3	Chemistry of Engineering materials & catalysis	6	6	4	16	CCH104-3
II /4	Water	4	4	4	12	CCH104-4
II /5	Metallurgy & Alloys	6	4	4	14	CCH104-5
II / 6	Lubricants, Paints & Varnish	4	4	2	10	CCH104-6
	Total Marks				70	

I: - ASSESSMENT CRITERIA

i) Formative Assessment of Practical / Self learning assessment: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	**Particulars**	**Marks out of 25**
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical: -

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
TOTAL		**25**

J) INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration
4. Charts
5. Simulation videos

K) TEACHING AND LEARNING RESOURCES: -

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
1.	Jain & Jain	Engineering chemistry	Dhanpatrai publishing co.
2.	S. C. Rangawala	Engineering materials	Engineering publication
3.	Jain & Agarwal	Metallurgical Analysis	Agarwal publications
4.	O. P. Khanna	Material science & technology	Khanna publication on 2006
5.	Rollason	Metallurgy for Engineers	ASM publication
6.	J. C. Kuriacose	Chemistry in Engineering & Vol. 1 & 11	-
7.	P. C. Jain	Chemistry of Engineering Materials	-
8	S. S. Dara	A text of Engineering Chemistry	-
9.	R. Gopalan, D. Venkappa	Engineering Chemistry	Vikas Publishing House.

M) LEARNING WEBSITE & SOFTWARE

a. www.substech.com
b. www.kentchemistry.com
c. www.chemcollective.org
d. www.wqa.org
e. www.chemistryteaching.com
f. www.ancient-origins.net/hisotry-famous-people/indian-sage-acharya-kanad-001399

*****

COURSE ID : ME
Course Name : ENGINEERING GRAPHICS (CE/ME/MT)
Course Code : CCH106
Course Abbreviation: HGRB
Course Type : DSC

A. LEARNING SCHEME:

Pre-requisite Course(s): Nil

Teaching Scheme:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	02	**3**
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	04	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	06	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL				Based on Self Learning		Total Marks
					Practical						
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
4	30	70	100	40	50	20	-	-	-	-	150

Total IKS Hrs for Sem: 2 Hrs

C. ABBREVIATIONS: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONAL:

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. This course is useful in developing drafting and sketching skills in the student. It covers the knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian Standards related to engineering drawing. The curriculum aims at developing the ability to draw and read various engineering curves, projections and dimensioning styles. The subject mainly focuses on use of drawing instruments, developing imagination and translating ideas into sketches. The course also helps to develop the idea of visualizing the actual object or part on the basis of drawings and blue prints. This preliminary course aims at building a foundation for the further courses related to engineering drawing and other allied courses in coming semesters

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

- Prepare simple engineering drawing manually using drawing instruments.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

CCH106-1 Understand various fundamentals in engineering drawing.
CCH106-2 Produce different types of engineering curves.
CCH106-3 Produce the projection of point & lines inclined to one reference plane.
CCH106-4 Produce the projection of different planes.
CCH106-5 Produce orthographic drawing and sectional orthographic drawing from given pictorial view.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and COs	Programme outcome POs and PSO's								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
CCH106-1	3	-	-	-	-	-	-	-	-
CCH106-2	3	-	1	-	-	-	-	-	-
CCH106-3	3	-	-	1	1	-	-	-	-
CCH106-4	3	-	1	-	-	-	-	-	-
CCH106-5	3	-	1	1	-	-	-	-	-

F. CONTENT:

i) Practical exercises

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted in the *Drawing Hall for Engineering drawing* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Draw horizontal, vertical, 30-degree, 45 degrees, 60 & 75-degrees lines using Tee and Set squares/ drafter.	4	CO1
2	Draw different types of lines, dimensioning styles	4	CO1
3	Draw one figure showing dimensioning techniques, two problems on redraw the figures. (Sketch Book)	4	CO1
4	Draw one figure showing dimensioning techniques, two problems on redraw the figures and one problem on Scales. (01 Sheet)	4	CO1
5	Draw any four Engineering Curves (Sketchbook)	4	CO2
6	Draw any four Engineering Curves – (01 Sheet)	4	CO2
7	Draw any four problems on Line parallel to both the principal planes Line parallel to one principal planes & perpendicular to other Principal planes using first angle method of projection. (Sketchbook)	4	CO3 CO5
8	Draw any four problems on Line parallel to one principal plane & inclined to other principal planes using first angle method of projection - (01 Sheet)	4	CO3 CO5
9	Draw any four problems on Plane parallel to one principal plane & perpendicular to another Principal plane, Plane perpendicular to both the principal planes using first angle method of projection. (Sketchbook)	4	CO4 CO5
10	Draw any four problems on Plane inclined to one principal plane and perpendicular to other principal plane using first angle method of projection - (01 Sheet)	4	CO4 CO5
11	Draw two problems on orthographic projections using first angle method of projection having plain surfaces, slanting surfaces and slots etc.	4	CO5
12	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs etc. (Sketchbook)	4	CO5

13	Draw two problems on orthographic projections using first angle method of projection having plain surfaces, slanting surfaces cylindrical surfaces, ribs and slots etc.- (01 Sheet)	4	CO5
14	Draw different types of sections of simple objects (Sketchbook)	4	CO5 CO6
15	Draw two problems on sections of solids having ribs, cylindrical surface etc. (01 Sheet)	4	CO5 CO6
16	Correlate ancient Indian sculptures, Indian temples, Monuments, etc. with Engineering Graphics. (IKS)	4	CO1 CO2 CO3 CO4 CO5

ii) THEORY

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **CCH106-1** *Understand various fundamentals in engineering drawing*			
1.	**INTRODUCTION TO ENGINEERING DRAWING** 1.1 Drawing Instruments and their uses 1.2 Standard sizes of drawing sheets as per ISO-A series, Layout of sheet. 1.3 Letters and numbers (single stroke vertical) Convention of lines and their applications. 1.4 Scale (reduced, enlarged & full size) Plain scale and Diagonal scale. 1.5 Dimensioning technique as per SP-46 (Latest Edition), Elements of dimensioning, Types and applications of chain, parallel and Co-ordinate dimensioning	**04**	**06**

Course Outcome **CCH106-2** *Produce different types of engineering curves*			
2.	**ENGINEERING CURVES** 2.1 Conic sections and their applications 2.2 Ellipse by Arcs of circle method & Concentric circles method. 2.3 Parabola by Directrix and focus method & Rectangle method 2.4 Hyperbola by Transverse Axis focus Method & Rectangular hyperbola (Inclined axes). 2.5 Involutes of circle, & pentagon, hexagon 2.6 cycloid, epicycloids, hypocycloid 2.7 Helix & Archimedean spiral.	**09**	**18**
Course Outcome **CCH106-3** *Produce the projection of point & lines inclined to one reference plane*			
3.	**PROJECTION OF POINT AND LINES** 3.1 Projection of points when point is in first quadrant only 3.2 Orientation of Line with respect to principal planes (Both ends of line should be in first quadrant) • Line parallel to both the principal planes • Line parallel to one principal planes & perpendicular to other Principal planes • Line parallel to one principal plane & inclined to other principal planes	**05**	**10**

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome **CCH106-*4*** *Produce the projection of different planes.*			
4.	**PROJECTION OF PLANES** 4.1 Types of Planes - Circular, Square, Triangular, Rectangular, Pentagonal, Hexagonal. 4.2 Orientation of plane with respect to principal planes (Planes in First Quadrant Only) – • Plane parallel to one principal planes & perpendicular to another Principal plane • Plane perpendicular to both the principal planes • Plane inclined to one principal plane and perpendicular to other principal plane	**03**	**10**
Course Outcome **CCH106-*5*** *Produce orthographic drawing and sectional orthographic drawing from given pictorial view.*			
5.	**ORTHOGRAPHIC PROJECTIONS** 5.1 Introduction to Orthographic Projections	**05**	**14**

	-First and Third angle Projection Method, their symbols 5.2 Conversion of Pictorial view into Orthographic Views. (First angle Projection Method Only)		
Course Outcome CCH106-5 *Produce orthographic drawing and sectional orthographic drawing from given pictorial view*			
6.	**SECTIONAL VIEWS** 6.1 Types of sections 6.2 Conversion of pictorial view into sectional Orthographic views. (First Angle Projection Method only)	**04**	**12**
Total		**30**	**70**
1. Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

- **NOT APPLICABLE**

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica-tion		
1	Introduction To Engineering Drawing	00	06	00	CCH106-1	06
2	Engineering curves	00	12	06	CCH106-2	18
3	Projection of Point and Lines	00	10	00	CCH106-3	10
4	Projection of Planes	00	00	10	CCH106-4	10
5	Orthographic Projection	00	00	14	CCH106-5	14
6	Sectional Views.	00	00	12	CCH106-5	12
	Total	00	28	42		**70**

I. ASSESSMENT CRITERIA

Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

i) Lectures cum Demonstrations,
ii) Class room practices.
iii) Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE MATERIAL:

Sr. No.	Author	Title	Publisher
1.	N. D. Bhatt	Engineering Drawing	Charotar Publishing House 2010
2.	Amar Pathak	Engineering Drawing	Dreamtech Press, 2010
3.	D. Jolhe	Engineering Drawing	Tata McGraw Hill Edu., 2010
4.	M. B. Shah, B. C. Rana	Engineering Drawing	Pearson, 2010
5.	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age Publication, Reprint 2006
6.	IS Code, SP – 46	Engineering Drawing Practice	Bureau of Indian Standards

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www.design-technology.info/IndProd/drawings/
2. https://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/
3. https://en.wikipedia.org/wiki/Engineering_drawing
4. https://www.engineeringdrawing.org/
5. https://www.teachengineering.org/view_activity
6. https://www.howtoread.co.in/2013/06/how-to-read-ed.html
7. https://www.slideshare.net/akhilrocker143/edp
8. https://www.24framesdigital.com/pstulpule

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COURSE ID : **ME**
COURSE NAME : **COMMUNICATION SKILLS**
COURSE CODE : **CCH201**
COURSE ABBREVIATION : **HCMS**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				150
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	-	-	25	10	

(Total IKS Hrs for Sem.: 00 Hrs)

C: ABBREVIATIONS: -

CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment **Legends:** @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as “Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Communication, being an integral part of every human activity, plays a fundamental role in education, science and technology. The communication skills are essential for engineering professionals to carryout routine tasks at workplace. These skills are also required for professional activities like dialogue, persuasion and negotiation. Considering the age group and socio-economical background of the students of the Institute, this course has been designed with a skill-oriented content with some necessary theoretical foundation. Thus, this course has been designed to enhance the skills to communicate effectively and skillfully at workplace.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. "Communicate in written and oral form of English effectively at workplace."

E. COURSE LEVEL LEARNING OUTCOMES (COs)

CCH201-1 Use Contextual words in English appropriately.
CCH201-2 Comprehend the concept of communication and identify communication barriers.
CCH201-3 Prepare and participate in dialogue, conversation, elocution and debate.
CCH201-4 Make effective use of body language & graphical communication.
CCH201-5 Write letters, reports, e-mails and technical description in correct language.
CCH201-6 Prepare and present effective media aided presentation.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life- long Learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	2	-	-	-	-	1	2		
CCH201-1	1	1	-	-	-	2	1		
CCH201-2	2	1	-	-	-	2	2		
CCH201-3	2	1	-	-	-	2	1		
CCH201- 4	2	-	-	-	-	2	2		
CCH201-5	2	-	-	-	-	2	1		
CCH201-6	1	1	-	-	-	1	1		

F. CONTENT:

I) PRACTICAL EXERCISES

The following practical exercises shall be conducted in the Laboratory for *Communication Skills* developed by the Institute in practical sessions of batches of about 20- 22 students:

Sr No.	Title of Practical Exercise	Course Outcome
1.	Vocabulary Building: Affixation	CCH201-1
2.	Vocabulary Building: Homophones	CCH201-1
3.	Vocabulary Building: Synonyms-Antonyms and Collocations	CCH201-1
4.	Communication Cycle and Communication Barriers	CCH201-2
5.	Oral Communication: Transcription	CCH201-3
6.	Oral Communication: Prepared Speech	CCH201-3
7.	Oral Communication: Conversation	CCH201-3
8.	Oral Communication: Group Discussion	CCH201-3
9.	Oral Communication: Group Debate	CCH201-3
10.	Non-verbal Communication: Graphic Communication	CCH201-4
11.	Non-verbal Communication: Body Language	CCH201-4
12.	Written Communication: Writing formal Letters	CCH201-5
13.	Written Communication: Writing Reports	CCH201-5
14.	Written Communication: Drafting of E-mail	CCH201-5
15.	Written Communication: Technical Writing	CCH201-5
16.	Presentation Aids	CCH201-6

II) THEORY

Section I

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH201-1 Use Contextual words in English appropriately.			
1	**Vocabulary Building** 1.1 Affixation: Prefix and Suffix, Definition and Examples, List of common Prefixes and Suffixes 1.2 Synonyms and antonyms: Vocabulary Expansion, Context and Usage 1.3 Homophones: Identifying Homophones, Meaning and Contest, Vocabulary Expansion 1.4 Collocation: Definition and Identification, Types of Collocations	8	08
CO: CCH201-2 Comprehend the concept of communication and identify communication barriers.			
2	**Introduction to Communication** 2.1 Definition and Importance of Communication 2.2 Model of Communication 2.3 Principles of Effective Communication 2.4 Types of Communication: Formal, Informal, Oral, Written, Verbal, Non-Verbal, Horizontal, Upward, Downward and Diagonal Communication 2.5 Barriers to communication: Physical, Mechanical, Psychological and Language Barriers	14	16
CO: CCH201-3: Prepare and participate in dialogue, conversation, elocution and debate.			
3	**Oral Communication** 3.1 Characteristics of Oral Communication. 3.2 Phonetics: IPA, Vowels (12), Consonants (24) and Diphthongs (12) 3.3 Tone, Pronunciation and Accents. 3.4 Spoken English: Prepared and Extempore speeches 3.5 Role Play: Conversation and Dialogue 3.6 Group Discussion and Debate	8	10

Section II

Sr. No.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH201-4: Make effective use of body language & graphical communication.			
4	**Non-verbal Communication** 4.1 Importance of Non-Verbal Communication. 4.2 Aspects of Body Language: Facial Expressions, Eye Contact, Vocalics, Gestures, Posture, Dress, Appearance and Personal Grooming and Haptics. 4.3 Non-Verbal Codes: Proxemics, chroemics, artefacts 4.4 Graphical Communication: 4.4.1 Advantages and Disadvantages of Graphical Communication. 4.4.2 Tabulation of Data and its depiction in the form of Bar Graphs and Pie Charts	08	12
CO: CCH201-5 Write letters, reports, e-mails and technical description in correct language.			
5	**Written Communication** 5.1 Characteristics of Written Communication. 5.2 Letter Writing: Application with Resume, Enquiry Letter, Order Letter and Complaint Letter 5.3 Writing Reports: Accident, Fall in Production Reports and Micro Project 5.4 Email Writing 5.5 Technical Writing: Object Description, Picture Description, Diary Writing 5.6 Paragraph Writing: Narrative, Descriptive and Technical	16	20
CO: CCH201-6 Prepare and present effective media aided presentation.			
6	**Media-Aided Presentations** 6.1 Media aids for Presentation: Strengths and Precautions 6.2 Planning, Preparing and Making a Presentation 6.3 Use of Presentation Media	06	04

** No questions will be asked on IKS learning subtopics in any question papers.

G : LIST OF ASSIGNMENTS/ACTIVITIES/MICRO-PROJECT UNDER SLA

**A learner should complete at least on major activity mentioned in the above list under the guidance of subject teacher.

Sr. No	List of Assignment (under SLA)	Hrs Allotted
1	Report different types of episodes and anecdotes	02
2	Seminar preparation and Presentation	04
3	Make a pod cost episode based on Indian freedom fighters.	02

4	Present summary of the editorial column of English news paper	02
5	Write review of on any one: short story, novel, film	02
6	Prepare a booklet on Indian scientist/ eminent persons	04
7	Prepare blog, vlogs and pod cast	04
8	Prepare questionnaire for interview on any one: industry personnel, social worker, entrepreneur and conduct interview.	02
9	Prepare charts/tables of vowels, diphthongs, consonant, organs of speech, vocabulary in English	02
10	Prepare charts/tables of types of communication, barrier in communication, aspects of body language	02
11	Prepare a micro project on a given topic.	04

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section/ Topic No.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Vocabulary Building	02	02	04	08	CCH201-1
I / 2	Introduction to Communication	04	06	06	16	CCH201-2
I / 3	Oral Communication	04	02	04	10	CCH201-3
II /4	Non-verbal Communication	04	02	06	12	CCH201-4
II /5	Written Communication	04	04	12	20	CCH201-5
II / 6	Media-aided Presentations	-	02	02	04	CCH201-6
	Total Marks				70	

I: -ASSESSMENT CRITERIA

a. Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		**25**

b. Summative Assessment of Practical:

J) INSTRUCTIONAL METHODS:

1. Lecture cum Demonstration,
2. Class room practices.
3. Use of projector and soft material for demonstration

K) TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication
1	Communication Skills	Sanjay Kumar ad Pushp Lata	Oxford University Press
2	Personality Development and Soft Skills	Brun K. Mitra	Oxford University Press
3	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill
4	Human Communication	Burgoon Michael	SAGE Publication Inc.
5	101 Ways to Better Communication	Elizabeth Hiemey	Pustak Mahal
6	Technical Writing and Professional Communication	Thomas Huckin and Leslie	McGraw-Hill College Division

M) LEARNING WEBSITE & SOFTWARE

1. www.nptel.com/iitm/
2. https://www.britishcouncil.in/english/learn-online
3. https://www.vocabulary.com
4. www.newagegolden.com
5. https://www.internationalphoneticassociation.org

*****

COURSE ID : ME
COURSE NAME : MECHANICAL WORKSHOP PRACTICES
COURSE CODE : MEH101
COURSE ABBREVIATION : HMWP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	02
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	00	
	NLH-Notional Learning	04	

B. ASSESSMENT SCHEME: -

Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	50	20	50@	20	-	-	100

(Total IKS Hrs. for Sem. :02 Hrs.)

C. ABBREVIATIONS: -

CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA -Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends: @Internal Assessment, *#OnLine Examination, @$InternalOnlineExamination .

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA PR of any course, then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes microproject/ assignment/ other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

Mechanical Workshop Practices mainly deals with Fitting, Plumbing and Wood working. A technician has to work in such an environment with his peers, superiors and subordinates for a major part of his life. Therefore, the emphasis on the practical work is needed for the primary experience of working in the team.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use different engineering tools for performing shop floor activities.

E. COURSE OUTCOMES:

MEH101-1: Practice safety in workshop and use firefighting tools and equipment.

MEH101-2: Prepare job using different tools in fitting shop

MEH101-3: Perform various operations using plumbing tools.

MEH101-4: Preparing simple components using carpentry tools.

MEH101-5: Produce simple job using different sheet metal operations.

F. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2** Problem Analysis	**PO 3** Design /development of solutions	**PO 4** Engineering Tools, Experimentation and Testing	**PO 5** Engineering practices for society, sustainability and environment	**PO 6** Project Management	**PO 7** Life-long learning	**PSO 1** Work in mfg & service sector	**PSO 2** Start entrepreneurial activity
Competency	1	-	-	3	-	-	-	2	-
MEH101-1	1	-	-	3	-	-	-	2	-
MEH101-2	1	-	-	3	-	-	-	2	-
MEH101-3	1	-	-	3	-	-	-	2	-
MEH101-4	1	-	-	3	-	-	-	2	-
MEH101-5	1	-	-	3	-	-	-	2	-

G. CONTENT

i) PRACTICAL EXERCISES:

Sr. No.	Topics/ Sub-Topics	Practical (Hours)/ Evaluation (Marks)
Course outcome: MEH101-1: *Practice safety in workshop and use firefighting tools and equipment.*		
01	**General Workshop Practice** 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	04/–
Course outcome: MEH101-1: *Practice safety in workshop and use firefighting tools and equipment.* ***MEH101-2:*** *Prepare job using different tools in fitting shop*		
02	**Fitting Shop** 2.1 Demonstration of different fitting tools-holding tools, marking & measuring tools, cutting tools, finishing tools, drilling and power tools and their specifications 2.2 Demonstration of different operations like marking, filing, cutting, drilling, tapping, dieing, chipping, scraping, grinding, sawing, reaming etc. 2.3 fitting shop machineries-care and maintenance, safety practices 2.4 One simple fitting job involving following operations- marking, punching, filing, chamfering, sawing, drilling, tapping etc. 2.5 One simple fitting job (Male Female assembly type) involving following operations- marking, punching, filing, chamfering, sawing, drilling, tapping etc.	14/14
Course outcome: MEH101-1: *Practice safety in workshop and use firefighting tools and equipment.* ***MEH101-3:*** *Perform various operations using plumbing tools.*		
03	**Plumbing shop** 3.1 Demonstration of Plumbing 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. Basic process cutting, threading. 3.4 Demonstration of PVC pipe joint with various PVC fittings & accessories 3.5 One job on simple pipe joint with nipple coupling for Standard pipe, Pipe threading using standard die set (One job per one group of 04 students) One job on T joint/elbow joint pipe fitting job as per given drawing. (One job per one group of 04 students)	14/12

Course outcome: MEH101-1: *Practice safety in workshop and use firefighting tools and equipment.* ***MEH101-4:*** *Preparing simple components using carpentry tools.*		
04	**Wood Working shop: -** 4.1 Demonstration of types of artificial woods such as plywood, block board, hardboard, laminated board, Veneer, fiber boards and their applications 4.2 Demonstration of different wood working tools such as carpentry vice, marking and measuring tools, holding tools, planning tools, cutting tools, drilling and boring tools saws, claw hammer, mallet, chisels, jack plane, smoothening plane, etc. 4.3 Demonstration of different wood working processes like marking, sawing, planning, chiseling, grooving, boring, Turning of wood etc. 4.4 Operate different machines & equipments in carpentry shop, their specifications and maintenance, safe practices. 4.5 One simple job involving measuring, marking, cutting, assembly etc. operations. (One job per one group of 04 students) One simple job involving cutting, planing, wood turning, joining, finishing, varnishing, etc. operations (One job per one group of 04 students)	14/12
Course outcome: Course outcome: MEH101-1: *Practice safety in workshop and use firefighting tools and equipment.* ***MEH101-5:*** *Produce simple job using different sheet metal operations.*		
05	**Sheet Metal Shop** 5.1 Demonstration of different sheet metal tools and machines. 5.2 Demonstration of sheet metal operations like Sheet cutting, Bending, Edging, End curling, Lancing, Riveting etc. 5.3 One Job involving sheet metal operations from Dustbin, Letter Box, Tray, Bucket etc. (One job per one group of 04 students)	14/12

The students will submit the following.

Workshop record book showing the details of the job viz. Drawing, Raw material size, time required completing the job. The journal consisting of the neat sketches, specifications, use of the hand tool, and hand operations based on the demonstration in all the trades during the practical work.

H. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical assignment shall be assessed for 50 marks as per following criteria:

Domain	**Particulars**	**Marks out of 50**
Cognitive	Understanding	10
	Application	10
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
TOTAL		**50**

ii) Summative Assessment of Practical:

Every student has to perform one practical within 2 hours at term end practical which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	10
2	Correct figures / diagrams	10
3	Skill (Finishing in dimensions)	20
4	Safety / use of proper tools	10
	Total	50

I. INSTRUCTIONAL STRATEGIES: -

i) Demonstration during Practicals.

ii) Workshop Record Book

J. TEACHING AND LEARNING RESOURCES: -

i) Shop Demonstration

ii) Hands on training on machine

K. REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
1	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
2	B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat Rai & Co.

L. LEARNING WEBSITE & SOFTWARE

i) http://nptel.ac.in

ii) https://www.vlab.co.in/

iii) https://ecoursesonline.iasri.res.in/

iv) www.egr.msu.edu/~pkwon/me478

*****

COURSE ID:
COURSE NAME : FUNDAMENTALS OF ICT (CE/ME/EE/MT/ET/IT)
COURSE CODE : CCH202
COURSE ABBREVIATION: HICT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	01	02
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	01	
	NLH-Notional Learning	04	

B. ASSESSMENT SCHEME:

Paper Duration	Theory				Based on LL &TSL				Based on SL		Total Marks
					Practical						
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
	-	-	-	-	25	10	25@	10	25	10	75

C. ABBREVIATIONS: -

CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends: @Internal Assessment, #External Assessment, *#OnLine Examination, @$InternalOnlineExamination .

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA PR of any course, then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes microproject/ assignment/ other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. RATIONALE:

In any typical business setup in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various software as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job. This course also presents an overview of emerging technologies so that students of different discipline can appraise the applications of these technologies in their respective domain.

E. COMPETENCY:

Apply Fundamental knowledge of computer system to work with simple applications.

Cognitive : i) State the basic parts of a computer system and relationships among component. ii) State characteristics and functions of CPU's, motherboard, RAM, Storage devices etc.

Psychomotor: i) Use computers for Internet services, Electronics Documentation, Data Analysis and Slide Presentation.

ii) Appraise Application of ICT based Emerging Technologies.in different domain.

Affective : Attitude of i) Precision ii) Accuracy iii) Safety iv) Punctuality

F. COURSE OUTCOMES:

CCH202-1 - Use computer system and its peripherals for given purpose
CCH202-2 - Prepare Business document using Word Processing Tool
CCH202-3 - Analyze Data and represent it graphically using Spreadsheet
CCH202-4 - Prepare professional Slide Show presentations
CCH202-5 - Use different types of Web Browsers and Apps
CCH202-6 - Explain concept and applications of Emerging Technologies

G. COURSE OUTCOMES AND PROGRAMME OUTCOMES (CO-PO) MATRIX

	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO 1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
CCH202-1	1	-	-	-	-	-	1		
CCH202-2	-	-	-	3	-	-	1		
CCH202-3	-	2	1	3	-	-	1		
CCH202-4	-	-	-	3	-	-	1		
CCH202-5	1	-	-	3	-	-	3		
CCH202-6	1	-	-	3	-	-	3		
Legends: - High:03, Medium:02, Low:01, No Mapping: -									

H. LABORATORY WORK:

Laboratory experiments and related skills to be developed:

Sr. No.	Title of Experiment	Skills to be developed	Course outcome
1.	a) Work with Computer System, Input/output devices, and peripherals. b)Work with files and folders	1.1 Identify various Input/output devices, connections and peripherals ofcomputer system 1.2 Work with Computer System, Input/output devices, and peripherals for manages files and folders for data storage.	CCH202-1
2.	Work with document files: a) Create, editand save document in Word Processing. b) Text, lines and paragraph levelformatting	2.1 Create and manage worddocument. 2.2 Apply formatting features on textat line, paragraph and page level.	CCH202-2
3.	Work with Images and Shapes in Word Processing.	3.1 Insert and edit images, shapes in adocument file	CCH202-2
4.	Work with tables in Word Processing.	4.1 Insert table and apply various tableformatting features on it.	CCH202-2
5.	Working with layout and printing a)Document page layout, Themes, andprinting. b) Use of mail merge with options.	5.1 Apply page layout features in wordprocessing. 5.2 Print a document by applyingvarious print options 5.3 Use mail merge in word processing	CCH202-2
6.	Create, open and edit Worksheet.	6.1 Enter and format data in aworksheet. 6.2 Insert and delete cells, rows andcolumns 6.3 Apply alignment feature on cell	CCH202-3
7.	Formulas and functions in Worksheet.	7.1 Create formula and “If” conditionon cell data 7.2 Apply various functions and namedranges in worksheet.	CCH202-3
8	Sort, Filter and validate data in Spreadsheet.	8.1 Implement data Sorting, Filtering and Data validation features in a worksheet.	CCH202-3
9	Charts for Visual Presentation in Spreadsheet.	9.1 Create charts using various chartoptions in spreadsheet.	CCH202-3

10	Worksheet Printing.	10.1 Print the worksheet by applyingvarious print options for worksheet	CCH202-3
11	Make Slide Show Presentation.	11.1 Apply design themes to the given presentation 11.2 Insert pictures text/images/shapesin slide 11.3 Use pictures text/images/shapesediting options.	CCH202-4
12	Use Tables and Charts in Slide	12.1 Add tables and charts in theslides. 12.2 Run slide presentation in differentmodes 12.3 Print slide presentation as handouts/notes	CCH202-4
13	a) Insert Animation effects to Text and Slides. b) Insert Audio and Video files in presentation	13.1 Apply animation effects to thetext and slides 13.2 Add/set audio and video files inthe presentation.	CCH202-4
14	a) Internet connection configuration b)Use Internet and Web Services.	14.1 Configure internet connection ona computer system 14.2 Use different web services oninternet	CCH202-5
15	Working with Browsers.	15.1 Configure different browsersettings 15.2 Use browsers for the givenpurpose	CCH202-5
16	Prepare Web Forms for Survey.	16.1 Create web forms for surveyusing different options.	CCH202-6
17	Prepare Web Forms for Quiz	17.1 Create web forms for Quiz usingdifferent options	CCH202-6

I. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING SKILLS DEVELOPMENT (SELF LEARNING)

Self Learning

Following are some suggestive self-learning topics: 1) Use ChatGPT/any other AI tool to explore information 2) UseCalendar to Schedule and edit activities. 3) Use Translate app to translate the given content from one languanother. 4) Use cloud-based storage drive to store and share your files.

Assignment

Prepare journal of practical performed in the laboratory.

Micro project

The microproject has to be industry application based, internet-based, workshop-based, laboratory-based o

based as suggested by Teacher. 1) Perform a survey on various input and output devices available in market aits report. 2) Prepare Time Table, Prepare Notes on Technical Topics, Reports, Biodata with covering letter (S teacher shall assign a document to be prepared by each student) 3) Prepare slides with all Presentation feature as: classroom presentation, presentation about department, presentation of Technical Topics. (Subject teacher assign a presentation to be prepared by each student). 4) Student Marksheet, Prepare Pay bills, tax statement, assessment record using spreadsheet. (Teacher shall assign a spreadsheet to be prepared by each student). 5) CSurvey on different web browsers. 6) Generate resume for different job profile, survey report of any industry ChatGPT/any other AI tool.

J. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications
1	a) Computer System with all necessary Peripherals and Internet connectivity. b) Any Office Software c) Any Browser (Any General-Purpose Computer available in the Institute)

K. CONTENT:

Sr. No.	Topics / Sub-topics	Lectures (Hours)
Course Outcome CCH202-1 - Use computer system and its peripherals for given purpose.		
1	**Unit - I Introduction to Computer System** 1.1 Basics of Computer System: Overview of Hardwareand Software: block diagram of Computer System, Input/Output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit 1.2 Internal components: processor, motherboards, randomaccess memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives) 1.3 External Devices: Types of input/output devices, typesof monitors, keyboards, mouse, printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD, Hard disk and pen drive 1.4 Application Software: word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editingsoftware, graphics manipulation software System Software compilers, linkers, device drivers, operating system 1.5 Network environments: network interface cards, hubs,switches, routers and modems, concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth 1.6 Working with Operating Systems: Create and manage file and folders, Copy a file, renaming and deleting of filesand folders, Searching files and folders, application installation, creating shortcut of application on the desktop.	2

Sr. No.	Topics / Sub-topics	Lectures (Hours)
Course Outcome CCH202-2 - Prepare Business document using Word Processing Tool.		
2	**Word Processing** 2.1 Word Processing: Overview of Word processor Basicsof Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting application. 2.2 Editing a Document: Navigate through a document,Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting 2.3 Changing the Layout of a Document: Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs 2.4 Inserting Elements to Word Documents: Insert and delete a page break, Insert page numbers, Insert the dateand time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture 2.5 Working with Tables: Insert a table, Convert a table totext, Navigate and select text in a table, Resize table cells,Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent page. Working with Columned Layouts and Section Breaks:a Columns, Section breaks, Creating columns, Newsletterstyle columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust	3
Course Outcome CCG201-3: Design files of word processors, spreadsheets, presentation software, and database application.		
3	**Spreadsheets** 3.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and openWorkbook. 3.2 Editing Worksheet: Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments,Add Text Box, Undo Changes, - Freeze 3.3 Formatting Cells and sheet: Setting Cell Type, SettingFonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades,Sheet Options, Adjust Margins, Page Orientation, Headerand Footer, Insert Page Breaks, S 3.4 Working with Formula: Creating Formulas, CopyingFormulas, Common spreadsheet Functions such as sum,average, min, max, date, In, And, or, mathematical functions such as sqrt, power, applying conditions usingIF. 3.5 Working with Charts: Introduction to charts, overviewof different	3

Sr. No.	Topics / Sub-topics	Lectures (Hours)
	types of charts, Bar, Pie, Line charts, creatingand editing charts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart ina separate sheet. Advanced Operations: Conditional Formatting, DataFiltering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.	
Course Outcome CCH202-4 - Prepare professional Slide Show presentations		
4	**Presentation Tool** 4.1 Creating a Presentation: Outline of an effective presentation, Identify the elements of the User Interface,Starting a New Presentation Files, Creating a Basic Presentation, Working with textboxes, Apply Character Formats, Format Paragraphs, View a Prese 4.2 Inserting Media elements: Adding and Modifying Graphical Objects to a Presentation - Insert Images into aPresentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format 4.3 Working with Tables: Insert a Table in a Slide, FormatTables, and Import Tables from Other Office Applications.Working with Charts: Insert Charts in a Slide, Modify Chart, Import Charts from Other Office Applications.	4
Course Outcome ***CCH202-5 - Use different types of Web Browsers and Apps*** ***CCH202-6 - Explain concept and applications of Emerging Technologies***		
5	**Basics of Internet and Emerging Technologies** 5.1 World Wide Web: Introduction, Internet, Intranet, Cloud, Web Sites, web pages, URL, web servers, basic settings of web browsers-history, extension, default page,default search engine, creating and retrieving bookmarks,use search engines effectively for 5.2 Web Services: e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking 5.3 Emerging Technologies: IOT, AI and ML, Drone Technologies,3D Printing Tools: Docs, Drive, forms, quiz, Translate and otherApps	3

L. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Lab performance, Assignment, Self-learning and Seminar/Presentation

Summative Assessment (Assessment of Learning)

- Lab. Performance, viva voce

M. PROGRESSIVE SKILLS TEST:

i) Criteria for Continuous Assessment of Practical work and Progressive skill Test:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	02
3	Neat & complete Diagram.	04
4	Observations & computer handling skill	02
5	Use of toolbar, menu bar and short cut keys.	04
6	Logical thinking and approach	04
7	Oral Based on Lab work and completion of task	04
	TOTAL	**25**

Assessment at semester end practical exam as per Pro-forma II.

ii) Criteria for assessment at semester end practical exam:

Sr. no	Criteria	Marks allotted
1.	Technical ability	10
2.	Communication skill	5
3.	Logical approach	10
	TOTAL	**25**

N. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

1. Lectures cum Discussions
2. Regular Home Assignments.
3. Laboratory experiences and laboratory interactive sessions

O. TEACHING AND LEARNING RESOURCES:

1. Chalk board 2. Slides (PPT) 3. Self-learning Online Tutorials

P. REFERENCE MATERIAL:

a) Books / Codes

Sr. No	Author	Title	Publisher
1	Goel Anita	Computer Fundamentals	Pearson Education, New Delhi, 2014, ISBN-13: 978-8131733097
2	Miller Michael	Computer Basics Absolute Beginner's Guide, Windows 10	QUE Publishing; 8th edition August 2015, ISBN: 978-0789754516
3	Alvaro Felix	Linux: Easy Linux for Beginners	Createv Space Independent Publishing Platform- 2016, ISBN-13: 978-1533683731
4	Johnson Steve	Microsoft Office 2010: On Demand	Pearson Education, New Delhi India, 2010. ISBN :9788131770641

Sr. No	Author	Title	Publisher
5	Schwartz Steve	Microsoft Office 2010 for Windows: Visual Quick Start	Pearson Education, New Delhi India, 2012, ISBN: 9788131766613
6	Leete Gurdy, Finkelstein Ellen, Mary Leete	OpenOffice.org for Dummies	Wiley Publishing, New Delhi, 2003 ISBN: 978-0764542220

Q. Suggested Websites and Portals

Sr. No	Link / Portal
1	https://www.microsoft.com/en-in/learning/office-training.aspx
2	http://www.tutorialsforopenoffice.org/
3	https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf
4	https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf
5	http://www.tutorialsforopenoffice.org/
6	https://www.tutorialspoint.com/computer_fundamentals/index.htm
7	https://www.tutorialspoint.com/word/
8	https://www.javatpoint.com/ms-word-tutorial
9	https://support.microsoft.com/en-au/office/word-for-windows-training-7bcd85e6-2c3d-4c3c-a2a5-5ed8847
10	https://www.javatpoint.com/excel-tutorial
11	https://support.microsoft.com/en-au/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb
12	https://www.javatpoint.com/powerpoint-tutorial
13	https://support.microsoft.com/en-au/office/powerpoint-for-windows-training-40e8c930-cb0b-40d8-82c4-b
14	https://www.geeksforgeeks.org/ms-dos-operating-system/
15	https://www.javatpoint.com/windows
16	https://www.javatpoint.com/what-is-linux
17	https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT
18	https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
19	https://www.javatpoint.com/machine-learning
20	https://www.skillrary.com/blogs/read/introduction-to-drone-technology
21	https://www.cnet.com/tech/computing/what-is-3d-printing/
22	https://support.google.com/a/users/answer/9389764?hl=en

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COURSE ID : ME
COURSE NAME : YOGA & MEDITATION.
COURSE CODE : CCH203
COURSE ABBREVIATION : HYAM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	01
	Tutorial Learning	00	
	Laboratory Learning	01	
	SLH-Self Learning	01	
	NLH-Notional Learning	02	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	50
-	-	-	-	-	25	10	-	-	25	10	

(Total IKS Hrs for Semester: 01Hr)

C: ABBREVIATIONS: -

CL-Class-Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends: @Internal Assessment, #External Assessment, *#OnLine Examination, @$Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for these muster are(CL+LL+TL+SL)hrs.*15Weeks
5. 1(one)credit is equivalents to30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes microproject/assignment/other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE

Diploma Graduate needs a sound body and mind to face the challenging situations in career as employee or as an entrepreneur. Yoga and Meditation bring about the holistic development of an individual and equips with necessary balance to handle the challenges. The age of polytechnic student is appropriate to get introduced to yoga practice as this will help them in studies as well as his professional life. Moreover, Yoga inculcates discipline in all walks of the life of student. Pranayama practice regulates breathing practices of the student to improve stamina, resilience. Meditation empowers a student to focus and keep calm to get peace of mind.

World Health Organization (WHO) has also emphasized the role of yoga and meditations stress prevention measure. National Education Policy -2020 highlights importance of yoga and meditation amongst students of all ages. Therefore, this course for Diploma students is designed for the overall wellbeing of the student and aims to empower students to adopt and practice Yoga in daily life.

ii) INDUSTRY/EMPLOYEREXPECTEDOUTCOME

By practicing basic yoga and pranayam in daily life, candidate should have attained the state of sound physique and balance mind to execute daily duties.

E. COURSE LEVEL LEARNING OUT-COMES (COS)

Students will be able to achieve & demonstrate the following Cos on completion of course based learning-

CCH203-1 Practice basic Yoga and Pranayam in daily life to maintain physical and mental fitness.

CCH203-2-Practice meditation regularly for improving concentration and better handling of stress and anxiety.

CCH203-3-Follow healthy diet and hygienic practices for maintaining good health.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6Project Management	PO-7 Life Long Learning	PSO 1 Work in mfg & service sector	PSO 2 Start entrepre neurial activity
CO1	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	3	-	1	-	-
CO3	-	-	-	-	3	-	1	-	-
Legends: -High:03, Medium:02, Low:01, No Mapping: - *PSOs are to be formulated at institute level									

F.CONTENT:

i) PRACTICAL EXERCISES

Sr.No	Laboratory Experiment/Practical Titles/Tutorial Titles	Learning Of hrs.	Relevant COs
1	Introduction: - 1.1 Introduction to AshtangYog 1.2 Presentations on Introduction to Yoga and its History, Omkar chanting, prayer, Padmasan, Siddhasan & Vajrasan Lab Exp: 1. Perform warming up exercises to prepare the body from head to toe for Yoga - i)Nack Movement ii) Shoulder Movement iii) Trunk Movement iv) Knee Movement v) Ankle Movement	03	CCH203-1
2	Lab Exp: 2. After warmup, perform all the postures of Surya Namaskar one by one in a very slow pace, Lab Exp 3. Perform multiple Surya-Namaskar (Starting with three and gradually increasing it to twelve) in one go. (Experiment 2to 4 must be followed by shavasana for self-relaxation.)	4	CCH203-1, CCH203-2
3	Lab Exp: 4 Perform Sarvangasna, Halasana, Kandharasana (setubandhasana), Uttanpadasan, Pavanmuttasan. LabExp:5 Perform Bhujangasana, Naukasana, Mandukasana. LabExp:6 Perform Shalbhasan, Dhanurasan, Vakrasan, Goumukhasan, Paschimottasana, Ardhamasendrasan LabExp: 7 PerformVeerasan, Veer-Bhadrasana, Vrukshasana, Trikonasana. (Follow up experiment 5 to7 with shavasana for self-relaxation)	4	CCH203-2
4	Lab Exp: 8 Perform Deep brathing, Anulom Vilom Pranayam Kriya LabExp:9 Practice Kapalbhati Pranayam Kriya, Bhastrika LabExp:10 Practice Bhramary Pranayam and Sheetali Pranayam	2	CCH203-3
5	Lab Exp: 11 Perform sitting in Dhyan Mudra and meditating. Start with five minute and slowly increasing to higher durations. Introduction to Vippasanna, Anappan& Chakras. (Trainer will explain the benefits of Meditation before practice)	2	CCH203-3

ii. THEORY: (NOT APPLICABLE)

G: LIST OF ASSIGNMENTS UNDER SLA

Sr. No.	List of Assignment (under SLA)	Hrs Allotted
1	Maintain a diary indicating date-wise practice done by the student with a photograph of self-yogic posture	02
2	Prepare Diet for and nutrition chart self	01
3	Practice at least thrice a week.	02
4	Read books on different methods to maintain health, wellness and to enhance mood	02
5	Watch videos on Yoga Practices.	01
6	Post your selfie with one asana on social media	02
7	Post your selfie with meditation posture on social media FB	02
8	Create your short video clip while performing one or two asanas	02
9	Create your short video performing Sun Salutation (Suyranamaskar)	01
	Total	**15**

****Candidate has to complete at least one major assignment from the given during his or her a single semester.**

- Maintain a diary indicating date wise practice done by the student with a photograph of self in yogic posture. Prepare Diet for and nutrition chart self

Assignment:

Prepare Diet for and nutrition chart for your self

- Self-**Learning**
  - Practice at least thrice a week.
  - Read books on different methods to maintain health, wellness and to enhance mood
  - Watch videos on Yoga Practices.

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

- **NA**

I: -ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per the following criteria

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Performance Skills	10
Affective	Discipline and Mind Balance	05
	TOTAL	**25**

J) INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations
2. Laboratory practices.
3. Use of third-party audio-visual material for demonstration
4. Demonstration Chart

K) TEACHING AND LEARNING RESOURCES:

Presentations, Yoga kits, Demonstrative charts, Actual Practice demonstration

L) REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication
1	Patanjalis Yoga Sutras	Swami Vivekananda	Fingerprint Publishing (2023) Prakash Books India Pvt Ltd, NewDelhiISBN-13?:?978-9354407017
2	Yoga for Every Body: A beginner's guide to the practice of yoga postures, breathing Exercises and me	Luisa Ray, Angus Sutherland	Vital Life Books (2022) ISBN-13?:?978-1739737009
3	Mudras for Modern Living: 49inspiring cards to boost your health, enhance your yoga and deepen your mind	Swami Saradananda	Watkins Publishing (2019) ISBN-13?:?978-1786782786
4	The Relaxation and Stress Reduction Workbook	Martha Davis, Elizabeth Robbins, Matthew McKay, Eshelman MSW	A New Harbinger Self-Help Workbook (2019)
5	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	Ann Swanson	ISBN-13:978-1465479358

M) LEARNING WEBSITE & SOFTWARE:

1 https://onlinecourses.swayam2.ac.in/aic19_ed28/preview- introduction to Yoga and Applications of Yoga
2 https://onlinecourses.swayam2.ac.in/aic23ge09/preview - YogaforCreativity
3 https://onlinecourses.swayam2.ac.in/aic23 e05/preview- YogaforCreativity
4 https://onlinecourses.nptel.ac.in/noc2lhs29/preview- Psychology of Stress, Health and Well-being
5 https://onlinecourses.swayam2.ac.in/aic23e0
6 preview- yoga for memory development
7 https://onlinecourses.swayam2.ac.in/ncel9sc04/preview-Food Nutrition for Healthy Living Course

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SEMESTER 2ND SCHEME AND CURRICULUM

GOVERNMENT POLYTECHNIC KOLHAPUR			
Learning and Assessment Scheme for Post S.S.C Diploma Courses			
Programme Name	**: Diploma In Mechanical Engineering**		
Programme Code	**: ME**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 15 WEEKS**
Semester	**: Second**	**Scheme**	**: MPECS 2023**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	APPLIED MATHEMATICS	HAMT	AEC	3	CCH301	2	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100
2	ENGINEERING PHYSICS-B	HPHB	DSC	1	CCH102	4	4	-	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
3	ENGINEERING DRAWING (ME/MT)	HEDR	AEC	1	CCH110	4	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
4	APPLIED MECHANICS	HAPM	DSC	1	CCH108	2	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
5	MANUFACTURING PROCESSES	HMPR	SEC	3	MEH301	1	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
6	SOCIAL AND LIFE SKILLS	HSLS	VEC	2	CCH204	-	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
Total						**13**	**17**	**2**	**12**	**9**	**40**	**20**		**150**	**350**	**500**		**100**		**100**		**150**		**850**

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprenti./Project./Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE ID : ME
COURSE NAME : APPLIED MATHEMATICS
COURSE CODE : CCH301
COURSE ABBREVIATION : HAMT

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	02	
	Laboratory Learning	-	
	SLH-Self Learning	00	
	NLH-Notional Learning	**06**	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Tutorial						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	**30**	**70**	**100**	**40**	**--**	**--**	**--**	**--**	**--**	**--**	**100**

(Total IKS Hrs. for Sem.: 02 Hrs.)

C. ABBREVIATIONS: -

CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment
Legends: @Internal Assessment, # External Assessment, *#OnLine Examination, @$Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self-learning hours shall not be reflected in the Time Table.

*Self-learning includes micro project /assignment/other activities. (The list of all assignments is given in tabular format. At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Mathematics is an important pre-requisite for the development and understanding of engineering and technological concepts. For an engineer and technologist, knowledge of Mathematics is an effective tool to pursue and to master the applications in the engineering and technological fields. Applied mathematics is designed for its applications in engineering and technology. It includes integration, differential equation, The connection between applied mathematics and its applications in real life can be understood and appreciated. Integral calculus helps in finding the area. Differential equation is used in finding curve, rectilinear motion. Statistics and probability will help a student to analyze data of large volume in their higher studies. The fundamentals of these topics are directly useful in understanding engineering applications in various fields.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME:

The course should be taught and implemented with the aim to develop the course outcomes (CO's) for the student to acquire the competency needed to apply the mathematical techniques for engineering subjects.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

CCH301-1: To solve examples on integration using various techniques
CCH301-2: To solve Differential equation of first order and first degree by various methods
CCH301-3: To find approximate solution of algebraic equations and simultaneous equations by various methods.
CCH301-4: - To solve problems on Probability distributions
CCH301-5: - Solve examples on Laplace Transform

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in Mfg & service sector	PSO2 Start entrepreneurial activity
Competency:									
CCH301-1	3	1	-	-	1	-	1		
CCH301-2	3	1	1	1	1	1	1		
CCH301-3	2	3	1	1	1	1	1		
CCH301-4	2	2	2	2	2	1	2		
CCH301-5	2	1	1	1	1	1	1		

F.CONTENT:

i) TUTORIAL EXERCISES

Any **TEN** of the following Tutorial exercises shall be conducted in the Tutorial room in tutorial sessions of batches of about 20- 22 students:

Sr. no	Tutorial experiences	**Number of hrs.**	**Relevant COs**
1	Solve simple problems of Integration by substitution.	02	CCH301-1
2	Solve integration using by parts.	02	CCH301-1
3	Solve examples on Definite Integral based on given methods.	02	CCH301-1
4	Solve problems on properties of definite integral.	02	CCH301-1
5	Solve given problems for finding the area under the curve and area between two curves. (Only for civil and mechanical engg. group)	02	CCH301-1
6	Solve examples on mean value and root mean square value. (Only for Computer, Electrical and Electronics engg. group)	02	CCH301-1
7	Solve first order first degree differential equation using variable separable method.	02	CCH301-2
8	Solve first order first degree differential equation using exact differential equation and linear differential equation.	02	CCH301-2
9	Solve engineering application problems using differential equation.	02	CCH301-2
10	Solve problems on Bisection method, Regula falsi and Newton-Raphson method.	02	CCH301-3
11	Solve problems on Jacobi's method and Gauss Seidel method.	02	CCH301-3
12	Use Bakshali iterative methods for finding approximate value of square root. (IKS)	02	CCH301-3
13	Solve engineering problems using Binomial Distribution, Poisson Distribution and Normal Distribution.	02	CCH301-4
14	Solve problems on Laplace transform and properties of Laplace transform.	02	CCH301-5
15	Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	02	CCH301-5

ii) Theory

Section I

Sr. no.	**Topics/Subtopics**	**Learning (Hours)**	**Classroom learning evaluation Marks**
Course Outcome CCH301-1: *To solve examples on integration using various techniques.*			
1	**Indefinite Integration** 1.1 Definition, Standard formulae 1.2 Rules of Integration (without proof), Examples 1.3 Integration by substitution	**14**	**16**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	1.4 Integration by parts 1.5 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction)		
***Course Outcome CCH301**-1: To solve examples on integration using various techniques*			
2	**Definite Integration** 2.1 Definition, Examples 2.2 Properties of Definite Integration (without proof), Examples based on properties	**8**	**8**
***Course Outcome CCH301**-2: To solve Differential equation of first order and first degree by various methods*			
3	**Differential equation** 4.1 Definition of differential equation 4.2 Order & degree of Differential equations 4.3 Methods of solving Differential equations of first order & first degree of following types: 4.3.1 Variable separable form 4.3.2 Exact Differential equations 4.3.3 Linear Differential Equations	**8**	**10**

Section –II

Sr. no.	Topics/Subtopics	Learning Hours	Classroom learning evaluation Marks
***Course Outcome CCH301**-3: - To find approximate solution of algebraic equations and simultaneous equations by various methods.*			
4	**Numerical Methods** 4.1Numerical solution of Algebraic Equations 4.1.1 Bisection Method 4.1.2 Regula- Falsi Method 4.1.3 Newton –Raphson method. 4.2 Numerical solution to simultaneous equations 4.2.1 Jacobi's Method 4.2.2 Gauss-Seidel method Bakhshali iterative method for finding approximate square root. (IKS)	**10**	**14**

Course Outcome CCH301-*4: - To solve problems on Probability distributions*			
5	**Probability Distribution** 5.1 Binomial distribution 5.2 Poisson's distribution 5.3 Normal distribution	**8**	**8**
Course Outcome CCH301-*5: - Solve examples on Laplace Transform.*			
6	**Laplace Transform** 6.1 Definition, Linearity property 6.2 Laplace Transforms of Standard functions (without proof) and examples 6.3 First shifting property and examples 6.4 Examples on Multiplication by t^n 6.5 Inverse Laplace Transform, Definition 6.6 Standard formulae (without proof) and examples 6.7 Inverse L.T.by using First shifting property 6.8 Inverse L.T. by using Partial fraction method	**12**	**14**

** No questions will be asked on IKS related subtopics in any question paper

G: Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Indefinite Integration	4	6	6	16	CCH301-1
I / 2	Definite Integration	-	4	4	8	CCH301-1
I / 3	Differential equation	2	4	4	10	CCH301-2
II /4	Numerical Methods	2	4	8	14	CCH301-3
II /5	Probability Distribution	-	4	4	8	CCH301-4
II/6	Laplace Transform	2	6	6	14	CCH301-5
	Total Marks				70	

H. -Assessment Criteria

i) Formative Assessment (Assessment for Learning)

- **Not Applicable**

ii) Summative Assessment (Assessment of Learning)

- **Not Applicable**

I. - Instructional Methods:

1. Lectures cum Demonstrations
2. Classroom practices
3. Use of projector and soft material for demonstration
4. Use of softwares such as Geogebra

J. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

K. Reference Books:

S.N.	Name of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal B.S.	Khanna publication New Delhi,2013 ISBN:8174091955
2	A textbook of Engineering Mathematics	Dutta. D.	New age publication New Delhi,2006 ISBN:978-81-224-1689-3
3	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi,2016 ISBN:978-81-265-5423-2
4	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi,2008 ISBN:978-81-219-0345-5
5	Introductory Methods of Numerical Analysis	S. S. Sastry	PHI Learning Private Limited, New Delhi.ISBN:978-81-203-4592-8
6	Studies in the History of Indian Mathematics	C. S. Seshadri	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
7	Calculus & Its Applications	Marvin L. Bittinger David J. Ellenbogen Scott A. Surgent	Addison-Wesley 10th Edition ISBN-13:978-0-321-69433-1
8	An Introduction to Statistical Learning with Application	Gareth James, Hastie Robert & Tibshirani	Springer New York Heidelberg Dordrecht London ISBN:978-1-4614-7138-7(eBook)

L) Learning Website & Software

1. http://nptel.ac.in/courses/106102064/1
2. https://www.woframalpha.com/
3. http://www.sosmath.com/
4. http://mathworld.wolfram.com
5. https://www.brilliant.org/
6. https://ocw.mit.edu/index.htm

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COURSE ID :ME
COURSE NAME : ENGINEERING PHYSICS (CE/ME/MT)
COURSE CODE : CCH102
COURSE ABBREVIATION : HPHB

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175

(Total IKS Hrs. for Sem.: 04 Hrs.)

C: ABBREVIATIONS: - CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment
Legends: @Internal Assessment, #External Assessment, *# Online Examination, @$Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self-learning hours shall not be reflected in the Time Table.

*Self-learning includes microproject / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Physics is the foundation of engineering and technology. The development of all engineering areas requires good understanding of fundamental principles in physics. Studying physics develops scientific methodology and technical aptitude in the students. Applications of principles of physics in engineering fields create interest and motivate the students.

ii) INDUSTRY/ EMPLOYER EXPECTED OUTCOME

Apply principles of Physics to solve engineering problems as follows:

Cognitive : i) Understanding and applying principles and laws of Physics to simple practical problems/ situations. ii) Observing iii) Classifying iv) Interpreting

Psychomotor : Handling of instruments, apparatus and tools

Affective : Skill of i) working in team ii) curiosity, interest and self-confidence

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH102-1 Estimate errors in measurement of physical quantities.

CCH102-2 Express importance of semiconductors and nanotechnology.

CCH102-3 Select proper material in engineering industry by analysis of its physical properties.

CCH102-4 Apply principles of electricity and magnetism to solve engineering problems.

CCH102-5 Apply principles of optics to solve engineering problems.

CCH102-6 Apply principles of acoustics and ultrasonics for related engineering applications.

Course outcomes and programme outcomes/ programme specific outcomes (co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"

Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design / Development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering Practices for society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO 1 Work in Mfg. & service sector**	**PSO2 Start entrepreneurial activity**
CCH102-1	3	1	-	1	1	1	1		
CCH102-2	3	-	-	-	1	1	1		
CCH102-3	3	1	-	1	1	1	1		
CCH102-4	3	1	-	1	1	1	1		
CCH102-5	3	1	-	-	1	1	1		
CCH102-6	3	-	-	-	1	1	1		

F.CONTENT:

i) PRACTICAL EXERCISES:

The following practical exercises shall be conducted in the *Laboratory for Physics developed* by the Institute in practical sessions of batches of about 20- 22 students:

Sr. no	Laboratory experiences	Number of hrs.	CO
1	To measure internal and external dimensions of hollow cylinder by using Vernier Caliper	02	CCH102-1
2	To measure the diameter of bob and thickness of plate by using Vernier Caliper	02	CCH102-1
3	To measure the diameter of bob and thickness of plate by using Micrometer screw gauge	02	CCH102-1
4	To determine forbidden energy band gap in semiconductors	02	CCH102-2
5	To determine the viscosity of liquid by Stokes method.	02	CCH102-3
6	To determine the buoyancy force on a solid immersed in a liquid	02	CCH102-3
7	To measure unknown resistance of wire by Ohm's law	02	CCH102-4
8	To verify series law of resistances	02	CCH102-4
9	To verify parallel law of resistances	02	CCH102-4
10	To draw magnetic lines of force for given magnet by using magnetic compass	02	CCH102-4
11	To verify Snell's law using glass slab	02	CCH102-5
12	To study variation of δ with i for a prism by pin method	02	CCH102-5
13	To determine velocity of sound by resonance tube	02	CCH102-6
14	To measure distance using ultrasonic meter	02	CCH102-6
15	To be added by the subject teacher as per requirement		

ii) THEORY

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome CCH102-1 *Estimate errors in measurement in Physical quantities.*			
1	**UNITS AND MEASUREMENT** 1.1 Unit, Physical Quantities: Fundamental and Derived Quantities and their units 1.2 Systems of units: CGS, MKS, FPS and SI 1.3 Errors, Types of errors: Instrumental, Systematic and Random error, Estimation of errors: Absolute, Relative and percentage errors 1.4 Significant figures 1.5 Ancient Astronomical Instruments: Chakra, Dhanuryantra, Yasti and Phalaka yantra (IKS learning) 1.6 **Simple Numerical problems**	**10**	**12**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome CCH*102-2** Express the importance of Semiconductors and nanotechnology.			
2	**INTRODUCTION TO SEMICONDUCTORS AND NANOTECHNOLOGY** **2.1 SEMICONDUCTORS** 2.1.1 Conductors, insulators and semiconductors 2.1.2 Energy bands 2.1.3 Intrinsic and extrinsic semiconductors 2.1.4 Minority and majority charge carriers 2.1.5 P and N type semiconductors 2.1.6 Properties of semiconductors 2.1.7 Applications of semiconductors **No numericals on above topic** **2.2 Nanotechnology** 2.2.1 Definition of nanoscale, nanometer, nanoparticle 2.2.2 Definition and examples of nanostructured materials 2.2.3 Applications of nanotechnology in electronics, automobile, textile, space, medicine, cosmetics and environment **No numericals on above topic**	**08** (06) (02)	**08** (06) (02)
Course Outcome CCH*102-3 Select proper material in engineering industry by analysis of its physical properties.*			
3	**PROPERTIES OF MATTER** **3.1 ELASTICITY** 3.1.1 Definitions of elasticity, plasticity, rigidity, deforming force, restoring force 3.1.2 Stress, Strain and their types 3.1.3 Elastic Limit, Statement of Hooke's law 3.1.4 Modulus of elasticity and its types, Relation between Y, K and η (No derivation) 3.1.5 Ultimate stress, breaking stress, Working stress, Factor of safety 3.1.6 Applications of elasticity 3.1.7 **Simple Numerical problems** **3.2 VISCOSITY** 3.2.1 Definition and meaning of viscosity, velocity gradient 3.2.2 Newton's law of viscosity, Coefficient of viscosity 3.2.3 Stokes law 3.2.4 Derivation of expression for coefficient of viscosity of liquid by Stokes method 3.2.5 Effect of temperature and adulteration on viscosity of liquids 3.2.6 Applications of viscosity **No numericals on above topic**	**12** (06) (06)	**14** (10) (04)

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome CCH**102-4 Apply principles of electricity and magnetism to solve engineering problems*			
4	**ELECTRICITY AND MAGNETISM**	**10**	**12**
	4.1 ELECTRICITY 4.1.1 Concept of charge, Coulomb's inverse square law, 4.1.2 Electric field, Electric field intensity 4.1.3 Electric potential and potential difference 4.1.4 Electric current, Resistance, Ohm's law 4.1.5 Specific resistance 4.1.6 Resistances in series and parallel	(06)	(08)
	4.1.7 **Simple Numerical problems**	(04)	(04)
	4.2 MAGNETISM 4.2.1 Magnetic field and magnetic field intensity and its units 4.2.2 Magnetic lines of force, magnetic flux **No numericals on above topic**		
***Course Outcome CCH**102-5 Apply principles of optics to solve engineering problems*			
5	**OPTICS**	**14**	**18**
	5.1 PROPERTIES OF LIGHT 5.1.1 Refraction of light 5.1.2 Laws of Refraction of Light, Snell's law 5.1.3 Refraction through glass prism 5.1.4 Dispersion & Dispersive Power (in terms of angles of deviation only)	(06)	(08)
	5.1.5 **Simple Numerical problems**	(04)	(06)
	5.2 LASER 5.2.1 Introduction of LASER 5.2.2 Properties of laser 5.2.3 Spontaneous and stimulated emission 5.2.4 Population inversion and optical pumping 5.2.5 Applications of LASER **No numericals on above topic**	(04)	(04)
	5.3 X-RAYS 5.3.1 Nature and properties of x-rays. 5.3.2 Production of x-rays by Coolidge tube 5.3.3 Applications of x-rays **No numericals on above topic**		

Course Outcome *CCH102-6 Apply principles of acoustics and ultrasonics for related engineering applications.*			
6	**ACOUSTICS AND ULTRASONICS** **6.1 ACOUSTICS** 6.1.1 Echo and reverberation of sound 6.1.2 Sabine's formula 6.1.3 Requirements of good acoustics 6.1.4 Acoustical planning of an auditorium **No numericals on above topic** **6.2 ULTRASONICS** 6.2.1 Limits of audibility 6.2.2 Ultrasonic waves 6.2.3 Ultrasonic transducers: Piezoelectric and Magnetostriction 6.2.4 Applications of ultrasonic waves **No numericals on above topic**	**06**	**06**

** No questions will be asked on IKS learning subtopics in any question papers.

G: LIST OF MICROPROJECTS/ ASSIGNMENTS/ OTHER ACTIVITIES UNDER SLA

Sr. No.	List of Microprojects (any one of the following under SLA)	Hrs Allotted
1	Prepare chart showing multipliers required for converting units of physical quantities.	02
2	Prepare prototype vernier caliper of desired least count using card sheet.	02
3	Collect information about ancient astronomical instruments like Chakra, Dhanuryantra, Yasti and Phalaka yantra.	02
4	Collect different materials such as metal, plastic, glass etc. and prepare models to show their electrical conductivity.	02
5	Collect different sizes of same material (e.g. sugar, salt etc.) and list the physical/electrical/optical/chemical/mechanical characteristics for each of them.	02
6	Prepare chart showing the three types of modulus of elasticity developed in a material.	02
7	Prepare working model to differentiate liquids on the basis of viscosity.	02
8	Prepare chart/models to demonstrate magnetic lines of force of different types of magnets.	02
9	Prepare chart/models for series and parallel combination of resistances of different values.	02
10	Prepare a model to demonstrate the variation of angle of refraction with respect to angle of incidence.	02
11	Use keychain laser to differentiate laser with ordinary light.	02
12	Prepare a presentation for application of x-rays in different fields.	02
13	Collect information using internet about ancient acoustic architecture. (For CE/ME/MT students)	02
OR		

Sr. No	List of Assignment (any one of the following under SLA)	Hrs Allotted
1	Write fundamental and derived Physical quantities with their SI units	02
2	Enlist the rules used to decide significant figures in measurements.	02
3	Write points to differentiate conductors, semiconductors and insulators on the basis of energy band diagram.	02
4	List applications of semiconductors in Civil, Mechanical, Electrical, Information Technology, Electronics and Telecommunication, Metallurgical Engineering etc.	02
5	Write down the applications of nanotechnology in the field of electronics, cosmetics, textile, environment, medical, space and defense, automobiles.	02
6	Write applications of elasticity.	02
7	Explain free fall of a sphere in a liquid column.	02
8	Write information of electric lines of force and magnetic lines of force.	02
9	Explain conversion of galvanometer into ammeter/voltmeter of desired range.	02
10	Draw ray diagrams showing different phenomena of light (reflection, refraction, dispersion etc.).	02
11	Enlist the properties and applications of laser.	02
12	Explain production of X-rays using Coolidge tube.	02
13	Write the information of factors to be considered while planning of an auditorium. (For CE/ME/MT students).	02
	AND	
Sr. No	**List of Activity (Compulsory activity under SLA)**	**Hrs Allotted**
	Write importance and significance of calibration of measuring instruments. Collect information of related industries in nearby industrial areas.	02

****One microproject/ assignment and given activity is to be completed during the semester.**

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Units and measurements	2	4	6	12	CCH102-1
I / 2	Introduction to Semiconductors and Nanotechnology	2	2	4	08	CCH102-2
I / 3	Properties of matter (Elasticity and Viscosity)	4	2	8	14	CCH102-3
II /4	Electricity and Magnetism	2	4	6	12	CCH102-4
II /5	Optics (Properties of light, Laser & X-rays)	6	6	6	18	CCH102-5
II / 6	Acoustics and Ultrasonics	2	2	2	06	CCH102-6
	Total Marks				70	

I: -ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Presentation (Observations, calculations & Result table)	05
Psychomotor	Operating Skills	05
	Drawing skills (Neat & complete circuit Diagram / schematic Diagram)	05
Affective	Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram / observation table	05
4	Observations / Calculations / Result / Graph	05
5	Safety / use of proper tools	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Attendance	05
2	Preparedness and workmanship	05
3	Presentation (neat figures/ diagrams/ tables/ graphs etc.)	05
4	Conclusion / Inference	05
5	Oral Based on microproject/ assignment/ activity	05
TOTAL		**25**

J) INSTRUCTIONAL METHODS:

1. Lectures cum Discussions
2. Regular Home Assignments
3. Laboratory work
4. Use of projector and soft material for demonstration

K) TEACHING AND LEARNING RESOURCES:

1. Chalk board 2. Video clips 3. Slides 4. Item Bank 5. Charts

L) REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication
1	Text book of Physics for class XI & XII (Part-I, II)	Narlikar	N.C.E.R.T Delhi
2	Engineering Physics	P.V.Naik.	Pearson Edu. Pvt. Ltd, New Delhi.
3	Concepts in Physics, Vol. I & II.	Narkhede, Pawar, Sutar	Bharti Bhawan Ltd, New Delhi.
4	Principles of Physics.	Walker, Halliday, Resnik	Wiley Publication. , New Delhi.
5	Engineering Physics	B.L. Theraja	S. Chand Publishers – New Delhi
6	Concept of modern physics	Beiser	Tata Mc-Graw Hill
7	Physics for Technicians	E. Zebro Wski	Tata Mc-Graw Hill
8	Engineering Physics	V. Rajendran	Tata McGraw-Hill Publications
9	The Archaic and The Exotic : Studies in the history of Indian astronomical instruments	Steeramula Rajeswara Sarma	Manohar Book Services
10	The Surya Siddhanta	Aryabhatta	Baptist Mission Press, Calcutta

M) LEARNING WEBSITE & SOFTWARE

1. http://www.physicsclassroom.com
2. http://scienceworld.wolfram.com/physics/
3. http://physics.about.com/
4. http://nptel.ac.in/course.php?disciplineId=115
5. http://nptel.ac.in/course.php?disciplineId=104
6. www.fearofphysics.com
7. www.science.howstuffworks.com
8. www.iksindia.org

*****

COURSE ID : ME
COURSE NAME : ENGINEERING DRAWING (ME/MT)
COURSE CODE : CCH110
COURSE ABBREVIATION: HEDR

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	02	4
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	04	
Self-Learning Hours (SLH)	02	
Notional Learning (NLH)	08	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
4	30	70	100	40	25	10	25 @	10	25	10	175

(Total IKS Hrs for Sem: 4 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Engineering drawing is the graphical language of Engineers. This is a graphical tool used by the Designers, Planners, Supervisors and Technicians to express their thoughts, ideas and concepts. It offers students an insight into the methods of dealing with engineering drawing problems. This course aims at developing the ability to read and draw Isometric view of a solid, also intends to develop the ability to visualize and draw curves of development of lateral surfaces of various solids. The main focus of the course is in developing imagination, drafting and sketching skills of students, also aims at building a foundation for further course in machine drawing and other allied subjects.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1) Use different drawing instruments for solving broad based engineering problems.
2) Improved drafting skills, imagination and planning of drawings.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

CCH110-1 Draw projections of given solids for various orientations.
CCH110-2 Draw isometric views of given component or from orthographic projections.
CCH110-3 Interpret the views & complete the missing view.
CCH110-4 Draw development of lateral surfaces of various solids.
CCH110-5 Draw proportionate free hand sketches.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepre neurial activity
Competency									
CCH110-1	3	-	-	-	-	-	1	2	
CCH110-2	3	-	1	1	-	-	1	2	1
CCH110-3	3	-	-	-	-	-	1	1	
CCH110-4	3	-	1	1	-	-	1	2	1
CCH110-5	3	-	-	-	-	-	1	2	

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Drawing Hall for Engineering drawing* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Draw any two problems on projection of solids with axis perpendicular to one of the principal projection planes.	04	CO1
2	Draw any two problems on projection of solids with axis inclined to one of the principal planes and parallel to the other. (Sketchbook)	04	CO1
3	Draw any two problems on projection of solids with axis parallel to both principal planes. (Sketchbook)	04	CO1
4	*Draw any four problems on projection of solids with axis inclined to one of the principal planes and parallel to the other. **(01 sheet)**	04	CO1
5	Draw two problems on Isometric view of simple objects having plain and slanting surfaces by using natural scale. (Sketchbook)	04	CO2
6	Draw two problems on Isometric Projection of objects having cylindrical surfaces and slots on slanting surfaces by using isometric scale. (Sketchbook)	04	CO2
7	*Draw one problem on Isometric Projection of objects having cylindrical surfaces and slots on slanting surfaces by using isometric scale, and one problem of isometric view by using natural scale **(01 sheet)**	04	CO2
8	Problem Based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views (sketch book).	04	CO3
9	Draw two problems on Missing view having plain and slanting surfaces, cylindrical surfaces and slots on slanting surfaces (Sketchbook)	04	CO3
10	Draw two problems on Missing view having cylindrical surfaces and slots on slanting surfaces **(01 sheet)**	04	CO3
11	Draw two problems on developments of lateral surfaces of cube, prisms.	04	CO4
12	Draw two problems on development of lateral surfaces of cylinder, pyramids.	04	CO4
13	*Draw four problems on developments of lateral surfaces of solids. **(01 sheet)**	04	CO4
14	*Draw freehand Sketches of 12 different standard components **(1 Sheet)**	04	CO5

15	Prepare a report on the use of various solid geometrical shapes employed in ancient Indian constructions (IKS).	04	CO1 CO2 CO3 CO4 CO5

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome* CCH110-1** *Draw projections of given solids for various orientations.*			
1.	**Projection of Solids** Projection of Solids like Cube, Prisms, Pyramids, Cone, Cylinders and Tetrahedron. 1.1. Axis of Solids perpendicular to one reference plane and Parallel to another Reference Plane) 1.2. Axis of Solids inclined to one reference plane and Parallel to another Reference Plane) **various solid geometrical shapes employed in ancient Indian constructions (IKS).	**08**	**16**
***Course Outcome* CCH110-2** *Draw isometric views of given component or from orthographic projections.*			
2.	**Isometric Projection** 2.1. Isometric Axes 2.2. Isometric scale 2.3. Isometric view and Isometric Projection 2.4. Conversion of Orthographic Views into Isometric View/Projection (Including rectangular, cylindrical objects, representation of slots on sloping as well as plane surfaces)	**08**	**18**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome* CCH110-3** *Interpret the views & complete the missing view.*			
3.	**Missing View** 3.1 Interpretation of the given two orthographic views and draw missing view from the given two Orthographic views. (First Angle Projection Method only)	**06**	**14**
Course Outcome* CCH110-*4 *Draw development of lateral surfaces of various solids.*			
4.	**Developments of Surfaces** 4.1 Methods of Development 4.2 Developments of Lateral surfaces of right solids Prism, Cylinder, Pyramid and Cone.	**06**	**12**

Course Outcome* CCH110-*5 *Draw proportionate free hand sketches.*			
5.	**Free Hand Sketches** 5.1 Profiles of Screw Threads (V (BSW, Sellers), Square, ACME, Buttress, Knuckle Thread) Conventional representation of threads. 5.2 Free hand sketches of nuts and bolts, Washer, Locking arrangement of nuts, Foundation bolts (Eye, Rag, Lewis), Riveted Joints.	**02**	**10**
Total		**30**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

*Complete all assignments mentioned below or any one microproject or activity given by subject teacher.

List of Assignments

Sr. No.	List of Assignment (under SLA)
1	Projection of solids. One problem for each type of solids.
2	Isometric Projection. Two problems on Conversion of orthographic views into isometric View/projection.
3	Missing View. Two problems on drawing missing view from the given two Orthographic views.
4	Development of lateral surfaces of solids. One problem for each type of solids.
5	Free Hand Sketches. Draw freehand Sketches of 8 different standard components.

Note: Assignments are aimed at enhancing the imagination and drawing skills of students. Separate books are recommended for assignments.

Suggested List of Microprojects

1. Collect industrial part/job and draw its Orthographic Views.
2. Prepare Wooden models of various solids.
3. Draw Development of various given solids by collecting component, job/sample from nearby workshops/industries.
4. Prepare a model of sheet metal from given development.
5. Prepare isometric drawing from any industrial drawing.

Suggested Activity for Students

Each student will assess at least one sheet of other students (May be a group of 4 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any. Similar other activities can also be considered.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Projection of Solids	0	0	16	**16**	CO1
I/2	Isometric Projection	0	0	18	**18**	CO2
II/3	Missing View	0	14	0	**14**	CO3
II/4	Developments of Surfaces	0	0	12	**12**	CO4
II/5	Free Hand Sketches	0	10	0	**10**	CO5
TOTAL			**22**	**48**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Drawing / drafting skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Drawing / drafting skills	10
	TOTAL	**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Engineering Drawing	N. D. Bhatt	Charotar Publishing House 2010
2.	Engineering Drawing	Dhawan, R. K.	S. Chand and Company New Delhi
3.	Engineering Drawing	D. A. Jolhe	Tata McGraw Hill Edu., 2010
4.	Engineering Drawing	M. B. Shah, B. C. Rana	Pearson, 2010
5.	Engineering Drawing	Agrawal Basant, Agrawal C.M.	McGraw Hill Education, New Delhi
6.	Engineering Drawing Practice	IS Code, SP – 46	Bureau of Indian Standards

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www.design-technology.info/IndProd/drawings/
2. https://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/
3. https://en.wikipedia.org/wiki/Engineering_drawing
4. https://www.engineeringdrawing.org/
5. https://www.teachengineering.org/view_activity
6. https://www.howtoread.co.in/2013/06/how-to-read-ed.html
7. https://www.slideshare.net/akhilrocker143/edp
8. https://www.24framesdigital.com/pstulpule

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COURSE ID : ME
COURSE NAME : APPLIED MECHANICS (CE/ME/MT)
COURSE CODE :CCH108
COURSE ABBREVIATION :HAPM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-------	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. LEARNING SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	175
03	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
	30	70	100	40	25	10	25@	10	25	10	

(Total IKS hours for sem: 02 hours)

C. ABBREVIATIONS: -

CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail andwill have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. RATIONALE:

The role of an engineer is to dream a mechanism for the present and the future generation. Understand the concept of existing mechanism thoroughly. An engineer in his initial stages of learning need to understand the basics of components of the machine, then forces in those components, interaction of these forces resulting in an engineering marvel or a mechanism. The contents of this most versatile basic course for engineering curriculum aims at providing fundamental meaning of various engineering principles and concept in engineering applications. The contents also form basic or primary set for higher level of subject such as strength of material, analysis of structures and design of steel structures and RCC structures. The subject being first and foremost entry level curriculum for the various programs in engineering it acts as gateway for engineering career. With the learning outcomes of the subject, learner can get clues for various fields such as mechanical, civil, metallurgical and varied courses like aerodynamics, space mechanics, marine structures. The subject being interdisciplinary in nature it comes under allied department applied mechanics.

E. COURSE LEVEL LEARNING OUTCOMES (COs):

CCH108-1 Understanding mechanisms for the interaction of various forces in their components with types and corresponding effects. With due focus on rigid body concept, principle of superposition resolution and composition of forces.

CCH108-2 Study of equilibrium for concurrent and non-concurrent force system and finding resultant and equilibrant graphically and analytically.

CCH108-3 Problems on equilibrium condition involving friction and support reactions in beams graphically and analytically.

CCH108-4 Knowing simple lifting mechanisms establishing law of machine, evaluating efficiency for set of loads.

CCH108-5 Studying equations of motion for rectilinear and circular motion, establishing relation between linear and angular motion parameters.

CCH108-6 Understanding effect of force for executing work, energy principles and conservation of energy concept.

Competency, course outcomes and programme outcomes/programme specific outcomes (CO-PO/PSO matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepreneurial activity
Competency: Applied Mechanics	3	2	2	2	3	1	2	2	2
CCH108-1	3	2	-	2	-	1	2	2	1
CCH108-2	3	2	1	2	-	1	2	3	1
CCH108-3	3	2	1	2	-	1	2	3	1

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepreneurial activity
CCH108-4	3	2	1	3	2	1	2	2	2
CCH108-5	2	1	1	2	-	1	2	1	1
CCH108-6	2	2	1	2	-	1	2	2	2

F. CONTENT:

i) LABORATORY WORK

Practical Exercise and related skills to be developed

The following exercises shall be conducted as practical work as detailed in laboratory manual for Applied Mechanics developed by the institute in practical sessions of batches of about 20- 22 students. In the list, Expt. No.1 to7 exercises are compulsory and from 8 to 12, any three exercises shall be conducted. in all 10 experiments are mandatory.

Sr no	Title of practical exercise	Course Outcome
1	Verification Law of parallelogram of forces	CCH108-1
2	Verification Law of polygon of forces	CCH108-1
3	Verification of Lamis theorem	CCH108-2
4	Determination of Beam reaction (Graphically and Analytically)	CCH108-2
5	Graphic statics (To find resultant of concurrent and non-concurrent force system)	CCH108-2
6	Determination of centroid (regular and irregular laminas)	CCH108-2
7	Determination of coefficient of friction between different surfaces	CCH108-3
8	Simple lifting machine introduction of basic terms Study of differential axle and wheel	CCH108-4
9	Screw jack Application and finding efficiency and its law	CCH108-4
10	Study of worm and worm wheel	CCH108-4
11	Gear mechanism (Either single or double)	CCH108-4
12	Experiment on simple pendulum to know dynamic characteristics	CCH108-5

ii) THEORY:

Section I

Sr no	Course content	Lecture hours (class room learning)	Theory Assessment marks
CO: CCH108-1 *Understanding mechanisms for the interaction of various forces in their components with types and corresponding effects. With due focus on rigid body concept, principle of superposition resolution and composition of forces.*			
1	**Force systems and principles** 1.1Rigid body concepts, physical quantities and their units 1.2 Free body diagram for various mechanisms 1.3 Force characteristics, definition, force and force system-principles and laws 1.4 Different type of actions and their representation, with their effect (resultant moment, couple etc.) 1.5 Application on force system – numerical on law of parallelogram of forces, law of polygon of forces	8	12
CO: CCH108-2 *Study of equilibrium for concurrent and non-concurrent force system and finding resultant and equilibrant graphically and analytically.*			
2	**Equilibrium of bodies** 2.1 Two force system resultant and equilibrium inference 2.2, Lami's theorem for three force system and its application 2.3 Varignos principle and its application 2.4 Solving graphically and analytically beams with roller and hinge support 2.5 Definition of centroid and centroid for standard areas / sections. Its determination experimentally for irregular areas	12	12
CO: CCH108-3 *Problems on equilibrium condition involving friction and support reactions in beams graphically and analytically.*			
3	**Friction on bodies and beam statics** 3.1 Laws of dry friction 3.2 Free body diagram to derive expression for μ_s&μ_k 3.3 Problems on block and ladder friction 3.4 Reaction in beams carrying point load and udl with hinge and roller support. 3.5 Beam carrying transverse loads and couple	10	10
	Total	**30**	**34**

Section II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH108-4 *Knowing simple lifting mechanisms establishing law of machine, evaluating efficiency for set of loads.*			
4	**Simple Lifting machines** 4.1Basic definition of terms involved in lifting mechanisms. 4.2 Different types of simple lifting machines such as simple gears differential axial and wheel, screw jack 4.3 Inclined plane and evaluating coefficient of static friction	12	14
CO: CCH108-5 *Studying equations of motion for rectilinear and circular motion, establishing relation between linear and angular motion parameters.*			
5	**Kinematics and kinetics** 5.1Kinamatics and kinetic equations of motion 5.2D Alembert's principle for dynamic equilibrium 5.3Kinetics for circular motion 5.4Evaluating dynamic characteristics of simple pendulum	10	12
CO: CCH108-6 *Understanding effect of force for executing work, energy principles and conservation of energy concept*			
6	**Work, power and energy** 6.1 Definition of work done and dot product of force and displacement vectors 6.2 Energy types and law of conservation of energy 6.3 Collision of bodies and problem solving 6.4 Power and its interpretation in different mechanism	8	10
	Total	**30**	**36**

G. List of Assignments/Microprojects under SLA

Sr. No	List of Microproject objectives	Format	Assessment criteria
1	Mechanism –free body diagrams, force equations and efficiency	Title: Objectives: Study scheme: 2* 15 = 30 hours planning Procedure: theory/ modeling Observations: Inference: Conclusion Bibliography	Objectives:5 marks Methodology:10 marks Presentation /inferences:10 marks
2	Equilibrium of static force systems - Buildings, Dams, Engineering structures case studies		
3	Gear systems –case studies		
4	Rope drives, weighing machines case studies		
5	Rolling, sliding friction field applications.		
6	Machine foundation aspects		

7	Vibration analysis of simple motions		
8	Motion of bodies, projectile, space mechanics preliminary studies		
9	Energy principles, fly wheel machine concept and applications		

**assignments/Microproject are to be completed during the semester.

H: Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Force systems and principles	4	4	4	12	CCH108-1
I / 2	Equilibrium of bodies	4	4	4	12	CCH108-2
I / 3	Friction on bodies and beam statics	4	2	4	10	CCH108-3
II /4	Simple Lifting machines	4	2	8	14	CCH108-4
II /5	Kinematics and kinetics	4	4	4	12	CCH108-5
II / 6	Work, power and energy	4	2	4	10	CCH108-6
	Total Marks				**70**	

I: -Assessment Criteria

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	**Particulars**	**Marks out of 25**
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	**Criteria**	**Marks allotted**
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment/microproject shall be assessed for 25 marks as per assessment shown in table of criteria G.

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. Teaching and Learning resources:

1. Chalk board 2.LCD presentations
3.Demonstrative kits 4. Demonstrative charts
5. Question Bank 6. Digital learning resources

L. REFERANCE BOOKS

a) Book / journals / IS code

Sr no	Name of Book	Author	Publication
1	Engineering Mechanics	S Timoshenko and young	McGraw- Hill,1995
2	Vector Mechanics for Engineer	Beer, Johnston	McGraw- Hill,1995
3	Engineering Mechanics	S S BHAVIKATTI S.S and Rajashekharappa K.G.	New age international publisher
5	Engineering Mechanics	K L KUMAR	Tata McGraw- Hill Publishing company Limited
6	Text book on engineering mechanics	Khurmi R .S.	S. Chand Publications, New Delhi
7	Engineering Mechanics	Singer F.L.	Harper and Row Pub. York.

M. Learning Website & Software

a. www.nptel.com/iitm/
b. www.howstuffworks.com/
c. www.vlab.com
d. https:// en.wikipedia.org/wiki/applied mechanics

*****

COURSE ID : ME
COURSE NAME : MANUFACTURING PROCESSES
COURSE CODE : MEH301
COURSE ABBREVIATION: HMPR

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	**04**
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	01	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	Theory				Based on LL & TL				Based on Self Learning		Total Marks
					Practical						
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
03	30	70	100	40	25	10	25@	10	25	10	175

(Total IKS Hrs for Sem. :01 Hrs)

C. ABBREVIATIONS: -

CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination .

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. *Self-learning hours shall not be reflected in the Time Table.

*Self-learning includes microproject/ assignment/ other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

Diploma graduates frequently encounter diverse manufacturing processes. This core manufacturing processes course aims to enhance student's comprehension of manufacturing methods, like turning, drilling, milling, casting, forming, and joining, etc.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Produce a given component using various manufacturing processes

E. COURSE OUTCOMES:

MEH301-1: Prepare a wooden pattern and prepare a mould for given pattern

MEH301-2: Produce a part using casting processes as per given drawing.

MEH301-3: Produce a part using joining processes as per given drawing.

MEH301-4: Produce a part using forming processes as per given drawing.

MEH301-5: Produce a part using a lathe and drilling machine as per given drawing.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP- CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design /development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	3	2	2	2	-	2	2	2	-
MEH301-1	3	2	2	2	-	2	2	2	-
MEH301-2	3	2	2	2	-	2	2	2	-
MEH301-3	3	2	2	2	-	2	2	2	-
MEH301-4	3	2	2	2	-	2	2	2	-
MEH301-5	3	2	2	2	-	2	2	2	-

F. CONTENT

i) PRACTICAL EXERCISES:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of Hrs.	Relevant Cos
1	*Produce a simple wooden pattern for the given component.	4	CO1
2	*Produce a simple wooden job involving measuring, marking, cutting, assembly etc. operations.	4	CO1
3	*Produce a sand mould for the given pattern.	4	CO1
4	*Produce a casting from the given mould.	4	CO2

5	*Fabricate structure using arc welding machine as per given drawing.	4	CO3
6	Demonstrate soldering/brazing operations.	4	CO3
7	Identify various welding defects from given castings.	2	CO3
8	Demonstrate components of a forging machine and its safety considerations.	2	CO4
9	*Produce a bolt head/cold chisel/hook using forging.	4	CO4
10	Demonstrate the various parts of rolling mill/machine and various safety aspects of it.	2	CO4
11	Demonstrate production process of washer.	2	CO4
12	*Produce a job on a lathe machine that comprises facing, plain turning and step turning operations as per the given drawing.	4	CO5
13	*Produce a job on a lathe machine that comprises taper turning and grooving operations as per the given drawing.	4	CO5
14	*Produce a job on a lathe machine that comprises knurling and chamfering operations as per the given drawing.	4	CO5
15	*Produce a job on a drilling machine comprising drilling and reaming operations as per the given drawing.	4	CO5
16	*Produce a job on drilling machine comprising tapping operation as per the given drawing.	4	CO5
17	Produce a job on a drilling machine comprising counter-boring operation as per the given drawing.	4	CO5

The students will submit the following.

Workshop record book showing the details of the job viz. Drawing, Raw material size, time required completing the job. The journal consisting of the neat sketches, specifications, use of the hand tool, and hand operations based on the demonstration in all the trades during the practical work.

ii) THEORY

SECTION I

Unit No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome- **MEH301-1**: Prepare a wooden pattern and prepare a mould for given pattern			
1	**PATTERN MAKING AND MOULDING** **PATTERN MAKING:** 1.1 Basic steps in making pattern 1.2 Pattern making materials (wood, plastics, rubbers, Plasters, waxes, metallic pattern) 1.3 Types of patterns: Single piece pattern, Split pattern, Match plate pattern, Sweep pattern, Skeleton pattern 1.4 Pattern making allowances: Shrinkage, draft, machining, distortion, rapping 1.5 Color coding for patterns and core boxes.	**09**	**14**

	Moulding: 1.6 Molding sand: Green, Dry, Loam, Facing, baking, Parting, Core 1.7 Properties of Molding sand 1.8 Core prints: Horizontal, vertical, hanging, balancing wing 1.9 Molding processes: Green sand, Dry sand, Machine and Shell Molding 1.10 Gating and risering system		
Course Outcome- **MEH301-2**: Produce a part using casting processes as per given drawing.			
2	**CASTING** 2.1 **Casting in Indus valley civilization (IKS) 2.2 Centrifugal casting, investment casting, shell moulding and applications, 2.3 Die casting methods: Hot chamber die casting method, Cold chamber die casting method 2.4 Defects in casting: Causes and remedies 2.5 Safety practices/ precautions in foundry shop.	**05**	**08**
Course Outcome- **MEH301-3**: Produce a part using joining processes as per given drawing			
3	**METAL JOINING PROCESSES** 3.1 Welding Processes: welding and weldability, types and classification of welding processes. 3.2 Gas welding: gas welding equipments, oxy-acetylene welding, types of flame. 3.3 Arc welding: arc welding equipments, flux shielded metal arc welding, TIG and MIG welding. 3.4 Resistance welding: Spot, Projection, Seam, Percussion. 3.5 Soldering and brazing process, Comparison, fillers, merits, demerits and applications. 3.6 Defects in welding joints: causes and remedies. 3.7 Safety practices/ precautions in welding shop.	**08**	**12**

SECTION II

Unit No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome- **MEH301-4**: Produce a part using forming processes as per given drawing.			
4	**FORMING PROCESSES** 4.1 Drop forging: Introduction to forging, upset forging, press forging, open die and closed die, forging operations- Fullering, Edging, Bending, Blocking 4.2 Rolling: Principle of rolling, hot and cold rolling and applications, rolling mill.	**09**	**14**

	4.3 Extrusion: Principles of extrusion, methods of extrusion: Direct, Indirect, Backward & Impact Extrusion 4.4 Press working operations: Cutting, bending, drawing, punching, blanking, notching, lancing 4.5 Press tool, simple, progressive and forming dies and applications. 4.6 Die set components: Punch and die shoe, guide pin, Bolster plate, Stripper, stock guide, feed stock, pilot 4.7 Safety practices/ precautions in forging and press shop.		
Course Outcome- **MEH301-5**: Produce a part using a lathe and drilling machine as per given drawing.			
5	**FUNDAMENTALS OF LATHE** 5.1 Basics of Machining: Single point cutting Tool and its nomenclature 5.2 Cutting tool materials, Tool signature, Tool angles 5.3 Mechanics of Chip formation, Types of Chips, Cutting fluids or coolants 5.4 Lathe machine: Classification, specification of centre lathe 5.5 Basic parts and accessories like chucks (three jaw, four jaw, and magnetic chuck), mandrels, rests, faceplate, centres and angle plate of centre lathe and their functions. 5.6 Lathe operations: facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling 5.7 Cutting parameters like speed, feed, depth of cut and machining time.	**09**	**14**
Course Outcome- **MEH301-5**: Produce a part using a lathe and drilling machine as per given drawing.			
6	**DRILLING MACHINES** 6.1 Drill machine: Classification, specification of drilling machine 6.2 Basic parts of radial drilling machine, Sensitive drilling and their function. 6.3 Drilling machine operations: Drilling, reaming, boring, counter sinking, counter boring, spot facing 6.4 Cutting parameters- speed, feed, depth of cut and machining time. 6.5 Twist drill nomenclature, Types of drills	**05**	**08**

G. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING /SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

i. Justify why lathe machine is called mother of all machines.
ii. Collect information regarding car bonnet manufacturing in automobile industry.
iii. Collect information of material used for preparation of pattern.
iv. Justify necessity of safety precaution in industries.
v. Prepare a list of machine tools seen in the industry during industrial visit.

Micro project

i. Prepare a list of machine tools available in the workshop of the institute.
ii. Prepare list of similar operations that can be performed on different machine tools.
iii. Collect specification of machine tools available in the institute workshop.
iv. Collect different welding equipments required for a welding shop.
v. Collect a information about operations required for key manufacturing.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Total Marks	Course Outcome
		Remember	Understand	Application		
1	Pattern making and Moulding	2	8	4	14	CO1
2	Casting processes	2	2	4	08	CO2
3	Metal joining processes	4	4	4	12	CO3
4	Forming processes	2	4	8	14	CO4
5	Fundamentals of Lathe machines	2	4	8	14	CO5
6	Drilling machines	2	2	4	08	CO5
	TOTAL	**14**	**24**	**32**	**70**	

I. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Every student has to perform one practical within 2 hours at term end practical which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	05
2	Correct figures / diagrams	05
3	Skill (Finishing in dimensions)	10
4	Safety / use of proper tools	05
	Total	**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL STRATEGIES: -

i) Lectures
ii) Model and Video Demonstration
iii) Demonstration during Practicals.
iv) Hands on training on machine

K. TEACHING AND LEARNINGRESOURCES: -

i) Chalk-Board
ii) LCD Projector

L. REFERENCE BOOKS:

Sr. No	Author	Title	Publisher with ISBN Number
1	P N RAO	Manufacturing Technology Vol-1	McGraw Hill, New Delhi. ISBN-1259062570, 9781259062575
2	P N RAO	Manufacturing Technology Vol-2	McGraw Hill, New Delhi, ISBN: 9789353160524
3	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Elements Of Workshop Technology Vol-1	Media Propoters & Publisher PVT. LMT. ISBN-13 5551234102415
4	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Elements Of Workshop Technology Vol-2	Media Propoters & Publisher PVT. LMT., ISBN: 978-8-185-09915-6.
5	D.P. Agrawal	Ancient Metal Technology and Archaeology of South Asia: a Pan-Asian perspective	Aditya Prakashan, New Delhi. ISBN: 9788173051777

M. LEARNING WEBSITE & SOFTWARE:

1. https://www.youtube.com/watch?v=Wc2gpWcmGK4
2. https://www.youtube.com/watch?v=DGsV6RhBnbM
3. https://www.youtube.com/watch?v=zzXdddrV2so
4. https://www.youtube.com/watch?v=2CIcvB72dmk
5. https://www.youtube.com/watch?v=-w7E88zox6w
6. https://www.youtube.com/watch?v=RyLvVMg84xs

*****

COURSE ID :
COURSE NAME : SOCIAL AND LIFE SKILLS
COURSE CODE : CCH114
COURSE ABBREVIATION: HSLS

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	1
	Tutorial Learning	00	
	Laboratory Learning	00	
	SLH-Self Learning	02	
	NLH-Notional Learning	02	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA –PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
00	00	00	00	00	00	00	-	-	50	20	**50**

(Total IKS Hrs for Sem.: 00 Hrs)

C: ABBREVIATIONS: -

CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment **Legends:** @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as “Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Life skills can be defined as abilities that enable an individual to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing, understanding attitudes, values, morals, social skills and better equip them to handle stress and build their self-efficacy, self-esteem and self-confidence.

Note: The course offers four different alternatives (modules) for achieving above outcomes. Students must complete any one module from the following given options.

A) MODULE-I : Unnat Maharashtra Abhiyan (UMA)
B) MODULE-II : National Service Scheme (NSS)
C) MODULE-III : Universal Human Values
D) MODULE-IV: Value Education (Unati Foundation)
E) MODULE-V : Financial Literacy (NABARD)

The institute can choose to offer any one MODULE to the groups of the students by taking into consideration the resources required and resources available in the institute. Different group of students may be offered different MODULE based on their choices.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Exhibit psychosocial competencies, workplace ethics, resilience, positive attitude, integrity and self- confidence

E. COURSE LEVEL LEARNING OUTCOMES (COs)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CCH114-1 - Develop ability to adapt to new challenges.
CCH114-2 - Manage emotions effectively.
CCH114-3 - Follow workplace ethics and practices
CCH114-4 - Manage time effectively.
CCH114-5 - Increased self-confidence to handle stress.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experiment ation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life- long Learning	PSO 1 Work in Mfg & service sector	PSO 2 Start entrepreneurial activity
Competency:									
CCH114-1	-	-	-	-	-	-	2	-	-
CCH114-2	-	-	-	-	-	-	2	-	-
CCH114-3	-	-	-	-	-	-	2	-	-
CCH114-4	-	-	-	-	-	2	2	-	-
CCH114-5	-	-	-	-	-	-	2	-	-
CCH114-6	-	-	-	-	-	2	2	-	-

F. CONTENT:

i) PRACTICAL EXERCISES: Not Applicable

ii) THEORY

Sr. No	Theory Learning Outcomes (TLOs) Aligned to COs.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the local problems	**Unit - I MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)** 1.1 Introduction to Societal Needs and respective stakeholders: Regional societal issues that need engineering intervention	Implementation Methodology: Considering the nature of the course designed, following points shall be considered while implementing the course.
		1.2 Multidisciplinary approach-linkages of academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc. 1.5 Problem Outline and stakeholders: Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal)	

	TLO 1.3 Design a methodology for fieldwork TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation TLO 1.5 Measure & quantify the quantities / systems parameters TLO 1.6 Write a report using information collected. Study the data collected from fieldwork and conclude the observations.	1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuring equipments .8 Format for measurement of identified attributes/ survey form and piloting of the same .9 Fieldwork: Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B .10 Analysis and Report writing Report writing containing- 1. Introduction of the topic 2. Data collected in various formats such as table, pie chart, bar graph etc. Observations of field visits and data collected.	i) Regroup in the batches of 5-6 students for conducting the fieldwork from the bigger group. ii) Assign a few batches of the students for this course to all the faculty members. iii) A group of course teachers will visit local governance bodies such as Municipal Corporations, Village Panchayats, Zilla Parishads, Panchayat Samitis to assess the small technological / engineering needs in their area of work. iv) The group of course teachers will carry out initial field visits to evaluate the various possibilities of field visits / various scenarios wherein students can conduct field work to measure / quantify the parameters / attributes. v) The course will be implemented in eight sessions and fieldwork. a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy b) Session II - VII - Society, stakeholders and value creation, measurements, rudimentary analysis and reporting c) Session VIII - Final closure session feedback and assessment d) Field work - 1. Pilot Visit - Pilot of survey instrument Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Data gathering 1. Summary Visit - Closure after analysis

2	TLO 2.1 Adoption of Village or Slum TLO 2.2 Survey and Problem Identification TLO 2.3 Conduct Project / Programs in the selected village / slum TLO 2.4 Undertake Special Camping Programme	**Unit - II MODULE II: National Service Scheme (NSS)** 2.1 Contacting Village/Area Leaders 2.2 Primary socio-economic survey of few villages in the vicinity of the institute. 2.3 Selection of the village for adoption - conduct of activities 2.4 Comprehensive Socio-Economic Survey of the Village/Area 2.5 Identification of Problem(s) 2.6 Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non-conventional energy, low-cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields. A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.	i) The teachers should visit the village / slum before adopting it for NSS activities. ii)The selected area should be compact. iii) The community people should be receptive to the ideas of improving their living standard. They should also be ready to coordinate and involve in the projects undertaken by the NSS for their up- liftment iv) The areas where political conflicts are likely to arise should be avoided by the NSS units. The area should be easily accessible to the NSS volunteers to undertake frequent visits to slums;
3	TLO 3.1 Love and Compassion (Prem and Karuna) TLO 3.2 Truth (Satya) TLO 3.3 Non-Violence (Ahimsa) TLO 3.4 Righteousness (Dharma) TLO 3.5 Peace (Shanti)TLO 3.6 Service (Seva)TLO 3.7 Renunciation (Sacrifice) Tyaga TLO3.8Gender Equality and Sensitivity	**Unit - III MODULE-III: Universal Human Values** .1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) .2 Truth (Satya) : Introduction, Practicing Truth (Satya) .3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) .4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) .5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) .6 Service (Seva) : Introduction, Practicing Service (Seva) .7 Renunciation (Sacrifice) Tyaga: Introduction, Practicing Renunciation (Sacrifice) Tyaga	i) Lectures ii)Demonstration iii) Case Study iv) Role Play v)Observations vi) Portfolio Writing vii) Simulation Motivational talks by Practitioners Site/Industry Visit

		Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity	
4	TLO 4.1 Punctuality TLO 4.2 Cleanliness, Hygiene and Orderliness TLO 4.3 Responsibility TLO 4.4 Gratitude and Appreciations TLO 4.5 Determination& Persistence TLO 4.6 Respect TLO 4.7 Team Spirit TLO 4.8 Caring & Sharing TLO 4.9 Honesty TLO 4.10 Forgive and Forget	**Unit - IV MODULE-IV: Value Education (Unnati Foundation)** 4.1 Punctuality, Icebreaker and Simple Greeting, Understanding & Managing Emotions, Introducing Self, The power of a Positive Attitude, talking about one's Family, talking about one's Family, making a Positive Impression, give word list for a Word based .2 Cleanliness, Hygiene and Orderliness, Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills, Greeting gestures, Gender Equality and Sensitivity .3 Responsibility, OCSEM- Visual Comprehension and Word-Based Learning, Goal Setting – Make it happen, Follow, Like &Share Unnati social media - Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management .4 Gratitude and Appreciation, Asking Simple Questions & Asking for the price, Stress Management, Student Referral process, Comprehending & Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process, OCSEM- E-Newspaper, Critical Thinking to overcome challenges .5 Determination and Persistence, Guiding and Giving Directions, Language Etiquette & Mannerism, . Unnati Philosophy, b. Unnati Branding - Follow, Like & Share Unnati social media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, give topics for Debate, describing a person/Objects, Refusal Skills,	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Chalk-Board

		Word List for Word based Learning .6 Respect, Comparing, OCSEM - Public Speaking, Student referral process, attending a phone call, Being a Good Team Player, Placement Process, At a Restaurant, Workplace ethics .7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy& b. Unnati Branding - Follow, Like & Share Unnati social media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and up skilling Caring and Sharing , Handling Customer queries, Flexibility & Adaptability, Student referral process, Writing a Resume, OCSEM- Public Speaking, Placement Process, Meditation/ Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project , 4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture .8 Reading & Visual Comprehension Forgive and Forget, Facing and Interview, OSCEM-Public Speaking, Attending a telephonic/Video interview & Mock Interview, Affirmation, Pat-a-Back & Closure (Valediction, Unnati Branding, Student Testimonials), Meditation/ Affirmation & Sponsor connect (Speak to UNXT HO)	
5	TLO 5.1 Literacy About Savings and Investments TLO 5.2 Literacy About Financial Planning	**Unit - V MODULE-V: Financial Literacy** .1 Introduction - Life Goals and financial goals .2 Savings and Investments - Three pillars of investments, Popular asset classes, Government	i) Online/Offline Mode of Instructions ii) Video Demonstrations iii) Presentations iv) Case Study v)Chalk-Board Collaborative learning

	TLO 5.3 Literacy About Transactions TLO 5.4 Literacy About Income, expenditure and budgeting TLO 5.5 Literacy About Inflation TLO 5.6 Literacy About Loans TLO 5.7 Literacy About the Importance of Insurance TLO 5.8 Literacy About the Dos and Don'ts in finances	schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments .3 Retirement planning .4 Cashless transactions .5 Income, expenditure and budgeting – Concepts and Importance .6 Inflation- Concept, effect on financial planning of an individual .7 Loans – Types, Management of loans, Tax benefits .8 Insurance – Types, Advantages, selection Dos and Don'ts in Financial planning and Transactions	

** No questions will be asked on IKS learning subtopics in any question papers.

G: LIST OF ASSIGNMENTS/ACTIVITIES/MICRO-PROJECT UNDER SLA

Suggestive list of activities during Regular as well as Special Camping (NSS Activities)

Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme it would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.

(a) Environment Enrichment and Conservation: The activities under this sub-theme would inter-alia, include:
(i) plantation of trees, their preservation and upkeep
(ii) Construction & maintenance of village streets, drains
(iii) Cleaning of village ponds and wells;
(iv) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
(v) Disposal of garbage & composting;
(vi) Prevention of soil erosion and work for soil conservation,
(vii) Watershed management and wasteland development
(viii) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.
(b) Health, Family Welfare and Nutrition Programme:
(i) Programme of mass immunization;
(ii) Working with people in nutrition programmes with the help of Home Science and medical college students;
(iii) Provision of safe and clean drinking water;
(iv) Integrated child development programmes;
(v) Health education, AIDS Awareness and preliminary health care.
(vi) Population education and family welfare programme;
(vii) Lifestyle education centres and counselling centres.

(viii)

(c) Programmes aimed at creating an awareness for improvement of the status of women:

(i) programmes of educating people and making them aware of women's rights both constitutional and legal;
(ii) creating consciousness among women that they too contributed to economic and social well-being of the community;
(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
(iv) imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

(i) work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
(ii) work with the organizations of child welfare;
(iii) work in institutions meant for physically and mentally handicapped;
(iv) organizing blood donation, eye pledge programmes;
(v) work in Cheshire homes, orphanages, homes for the aged etc.;
(vi) work in welfare organizations of women;
(vii) prevention of slums through social education and community action;

(e) Production Oriented Programmes:

(i) working with people and explaining and teaching improved agricultural practices;
(ii) rodent control land pest control practices;
(iii) weed control;
(iv) soil-testing, soil health care and soil conservation;
(v) assistance in repair of agriculture machinery;
(vi) work for the promotion and strengthening of cooperative societies in villages;
(vii) assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
(viii) popularization of small savings and assistance in procuring bank loans

(f) Relief & Rehabilitation work during Natural Calamities:

(i) assisting the authorities in distribution of rations, medicine, clothes etc.;
(ii) assisting the health authorities in inoculation and immunization, supply of medicine etc.;
(iii) working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
(iv) assisting and working with local authorities in relief and rescue operation;
(v) collection of clothes and other materials, and sending the same to the affected areas;

(g) Education and Recreations: Activities in this field could include:

(i) adult education (short-duration programmes);
(ii) pre-school education programmes;

(iii) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;
(iv) work in crèches;
(v) participatory cultural and recreation programmes for the community including the use of mass media for instruction and recreation, programmes of community singing, dancing etc.;
(vi) organization of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
(vii) programmes including discussions on eradications of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;
(viii) non- formal education for rural youth and
(ix) Legal-literacy, consumer awareness.

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

- Not Applicable

I: -ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Formative assessment (Assessment for Learning) report and presentation of fieldwork activities, self-learning (Assignment)

i) Summative Assessment of Practical:
(Assessment of Learning)

J) INSTRUCTIONAL METHODS:

1. Group Discussion, Flipped Classroom
2. Demonstration, Case Study, Role Play, Collaborative Learning, Cooperative Learning
3. Field Visit, Survey
4. Use of projector and soft material for Demonstration (ppt, audio, video etc.)

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication

1	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges on 'IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MAHARASHTRA' Districts Economic survey reports	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	UNICEF
2	Central Public Health and Environmental Engineering Organization	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
4	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
5	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team

M) LEARNING WEBSITE & SOFTWARE

1. https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/20160 1131501523808.pdf (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan)
2. https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/20160 6151454073708.pdf (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines)
3. https://censusindia.gov.in/census.website/ (A Website of Census of India)
4. https://gsda.maharashtra.gov.in/english/ (A Website of Groundwater Survey and Development Agency, GoM)
5. https://mrsac.gov.in/MRSAC/map/map (A Website where district-wise maps showcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.)
6. https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx (A Website of Jal Jivan Mission, Government of India)
7. https://cpcb.nic.in/ (A Website of Central Pollution Control Board, Government of India)
8. http://www.mahapwd.com/# (A Website of Public Works Department, GoM)
9. http://tutorial.communitygis.net/ (A Website for GIS data sets developed by Unnat Maharashtra Abhiyan)
10. https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U (A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society)
11. https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac (A keynote talk by Prof. Milind Sohoni, IIT Bombay, on Interdisciplinary Engineering: The Road Ahead)

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SEMESTER 3RD SCHEME AND CURRICULUM

GOVERNMENT POLYTECHNIC KOLHAPUR			
Learning and Assessment Scheme for Post S.S.C Diploma Courses			
Programme Name	**: Diploma In Mechanical Engineering**		
Programme Code	**: ME**	**With Effect from Academic Year**	**: 2024-25**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 15 WEEKS**
Semester	**: Third**	**Scheme**	**: MPECS 2023**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	THERMAL ENGINEERING	HTEG	DSC	3	MEH302	-	3	-	2	1	6	3	3	30	70	100	40	25	10	-	-	25	10	150
2	PRODUCTION DRAWING	HPDR	SEC	3	MEH303	-	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
3	MECHANICS OF MATERIALS	HMOM	DSC	3	MEH305	1	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
4	FLUID MECHANICS AND MACHINERY	HFMM	DSC	3	MEH306	1	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
5	BASIC ELECTRICAL & ELECTRONICS	HBEE	AEC	3	MEH309	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
6	COMPUTER AIDED DRAFTING	HCAD	SEC	3	MEH315	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
7	FUNDAMENTALS OF PYTHON PROGRAMMING	HFPP	AEC	3	MEH320	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
Total						**2**	**17**	**0**	**18**	**5**	**40**	**20**		**150**	**350**	**500**		**175**		**125**		**75**		**875**

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination
Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprenti./Project./Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancem Course (SEC) : 2, Generic Elective (GE) : 0

COURSE ID:
COURSE NAME : THERMAL ENGINEERING
COURSE CODE : MEH302
COURSE ABBREVIATION : HTEG

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning Hours	01	
	NLH- Notional Learning	06	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
03	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	150
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
	30	70	100	40	25	10	–	–	25	10	

(Total IKS Hrs for Sem.: 00 Hrs)

C. ABBREVIATIONS: -

LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours,
FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System,
SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination,
@$ Internal Online Examination.

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro projects / assignments / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Thermal Engineering is a fundamental branch of mechanical engineering dealing with the generation, transformation, transmission, and utilization of thermal energy. Understanding the principles of thermal engineering is essential for designing and analyzing systems that involve heat transfer and energy conversion, such as power plants, refrigeration systems, and internal combustion engines. This subject provides a comprehensive introduction to the principles of thermodynamics, the behaviour of ideal gases and steam, and the components and operations of steam power plants and heat exchangers. It also covers the basics of internal combustion engines, which are pivotal in automotive and industrial applications.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. A solid understanding of core thermal engineering principles and their applications.
2. Proficiency in using thermal systems and simulation tools.
3. Practical skills in designing, testing, and maintaining thermal systems.
4. Awareness of industry standards, safety, and environmental regulations.
5. A mindset geared towards innovation and adaptability.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH302-1 Apply fundamental concepts of thermodynamics to various thermodynamic systems.
MEH302-2 Determine various properties of steam using a steam table.
MEH302-3 Use suitable strategies to maintain steam turbine, steam condenser & cooling towers efficiently.
MEH302-4 Select proper heat exchanger for given application.
MEH302-5 Identify different components of an I.C. Engine.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in Mfg & service sector	PSO2 Start entrepreneurial activity
Competency:	3	2	2	2	2	2	2	3	2
MEH302-1	3	2	1	2	2	1	2	2	1
MEH302-2	3	3	2	2	1	2	1	2	1
MEH302-3	3	2	2	2	2	1	2	2	2
MEH302-4	3	2	2	2	2	1	1	2	1
MEH302-5	3	2	2	2	2	1	2	2	1

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Laboratory developed* by the Institute in practical sessions of batches of about 20- 22 students. (*mandatory practicals)

Sr. no	Title of Practical	Number of hrs.	CO
1	Determination of dryness fraction of steam	02	**MEH302**-1
2	Measurement of discharge of air using air box	02	**MEH302**-2
3	*Trace the path of flue gases and water steam circuit with the help of Fire Tube Boiler - Cochran Boiler	02	**MEH302**-3
4	*Trace the path of flue gases and water steam circuit with the help of Water Tube Boiler - Babcock & Wilcox Boiler.	02	**MEH302**-3
5	*Demonstration & working of Boiler Mountings (Any Two)	02	**MEH302**-3
6	*Demonstration & working of Boiler Accessories (Any Two)	02	**MEH302**-3
7	*Demonstration & working of Impulse & Reaction steam turbine.	02	**MEH302**-3
8	Illustrate the methods of compounding used in steam turbines.	02	**MEH302**-3
9	Demonstration & working of condensers a. Water Cooled condensers. b. Air cooled condensers.	02	**MEH302**-3
10	Observe simulation of Thermal Power Plant And write specifications of boilers, turbines, condensers and electrical generators.	02	**MEH302**-3
11	*Conduct a trial on conduction set up of metallic rod and calculate thermal conductivity.	02	**MEH302**-4
12	Conduct a trial on Stefan Boltzmann setup and calculate Stefan Boltzmann constant.	02	**MEH302**-4
13	Identify different equipment in laboratories having heat exchangers and classify heat exchangers. Write construction and working any 03 of above heat exchangers.	02	**MEH302**-4
14	Identify different components of multi cylinder I.C. Engine and write function of each component.	02	**MEH302**-5
15	Industrial visit (Collect information about boiler, accessories, mountings, condenser, cooling tower nozzle and turbines used in industry)	02	**MEH302**-4

ii) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome: MEH302**-1: Apply fundamental concepts of thermodynamics to various thermodynamic systems.*			
1	**Fundamentals of Thermodynamics** 1.1 Thermodynamic system, Types of systems- Open, closed & isolated system, Extensive and Intensive properties, Process and Cycle. Thermodynamic definition of work, heat, difference between heat and work, flow work, concepts of enthalpy and entropy. 1.2 Laws of Thermodynamics - Zeroth law, first law and second law of thermodynamics. Kelvin Planks, Clausius statements. Concept of Heat engine, Heat pump and Refrigerator. 1.3 Application of Laws of Thermodynamics - Steady flow energy equation and its application to boiler, turbine, and condenser. (No Numerical Treatment on above)	12	20
***Course Outcome: MEH302**-2: Determine various properties of steam using a steam table.*			
2	**Ideal Gases and Steam Fundamentals** 2.1 Characteristics gas constant and universal gas constant. *Derivation of characteristics gas equation. 2.2 Ideal gas processes – Isobaric, Isochoric, Isothermal, Isentropic, Polytropic and their representation on P-V and T-S diagrams. Determination of work, heat, internal energy, enthalpy change. (Simple numerical based on above) 2.3 Steam fundamentals - Applications of steam, generation of steam at constant pressure with representation on T-H & T-S chart. Types of steam: Wet, dry, superheated steam. Properties of steam: Sensible, latent, total heat, specific Volume, dryness fraction. use of a steam table. (Only simple numericals based on above).	12	14

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome: MEH302**-3: Use suitable strategies to maintain steam turbine, steam condenser & cooling towers efficiently.*			
3	**Components of Steam Power Plant** 3.1 Introduction to steam power plant, Components & layout of steam power plant. Steam Boiler- Definition as per IBR, function, Classification of boilers, Introduction to high pressure boiler, Construction & working of Lamont boiler & Benson Boiler. 3.2 Steam nozzle & Steam Turbines - Function, types, applications of steam nozzles. Steam turbine - Classification, Construction and working of Impulse and Reaction turbine. 3.3 Steam condensers - Dalton's law of partial pressure Function, classification of condensers, construction and working of surface condensers. Sources of air leakage and its effect. 3.4 Cooling Towers - Classification of cooling towers, Construction and working of natural, forced and induced draught cooling tower. (No numerical Treatment for this unit)	12	18
***Course Outcome: MEH302**-4: Select proper heat exchanger for given application.*			
4	**Heat Transfer & Heat Exchangers** 4.1 Modes of heat transfer - Conduction, convection and radiation. Conduction - Fourier's law, conduction through slab & composite wall. Convection - Newton's law of cooling, natural and forced convection. Radiation absorptivity, transmissivity, reflectivity, emissivity, black body, grey body, Stefan Boltzmann law. (Only simple numerical based on heat transfer by conduction through slab & composite wall.) 4.2 Heat Exchangers - Classification, construction and working of shell and tube, plate type heat exchanger and its applications	08	12
***Course Outcome: MEH302**-5: Identify different components of an I.C. Engine.*			
5	**Introduction to Internal Combustion. Engine** 5.1 Power Cycles – Carnot Cycle, Otto cycle, Diesel cycle, Dual Cycle and its representation on P-V and T-S diagram. (No numerical on above) 5.2 Basics of I.C. Engine – Engine terminology, Classification and application of IC engines, Construction & working of two stroke & four stroke I.C. engines (S.I. and C.I.)	04	06

** No questions will be asked on IKS learning subtopics in any question papers.

G. LIST OF ASSIGNMENTS UNDER SLA

1. Application of Laws of Thermodynamics**.**
2. Simple numericals on properties of steam.
3. Steam nozzle & Steam Turbines
4. Steam condensers & cooling towers.
5. simple numerical based on heat transfer by conduction through slab & composite wall.
6. Modes of heat transfer
7. Construction & working of two stroke & four stroke I.C.

Solve any of Five assignments on following given topics

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Fundamentals of Thermodynamics	8	6	6	20	**MEH302-1**
I / 2	Ideal Gases and Steam Fundamentals	6	4	4	14	**MEH302-2**
II /3	Components of Steam Power Plant	6	6	6	18	**MEH302-3**
II /4	Heat Transfer & Heat Exchangers	4	4	4	12	**MEH302-4**
II / 5	Introduction to Internal Combustion. Engine	2	-	4	06	**MEH302-5**
	Total Marks				**70**	

I. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result Table/ Calculations / Graph	5
5	Safety / use of proper tools	5
	Total	25

ii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Representation	05
2	Participation	05
3	Understanding	10
4	Correct figures / diagrams	05
	Total	**25**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Classroom practices.
3. Use of projector and soft material for demonstration
4. Charts and working models.

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. Reference Books:

S. N	Name of Book	Author	Publication
1	Thermodynamics: An Engineering Approach	Cengel, Yunus A., and Michael A. Boles.	McGraw-Hill Education.
2	Fundamentals of Thermodynamics	Sonntag, Richard E., and Claus Borgnakke	Wiley.
3	Engineering Thermodynamics	P.K. Nag	McGraw-Hill Education.
4	Thermal Engineering	R.K. Rajput	Laxmi Publications
5	Thermal Engineering	Mahesh M. Rathore	McGraw-Hill Education.

M. LEARNING WEBSITE & SOFTWARE

1. https://nptel.ac.in/courses/112105123
2. https://archive.nptel.ac.in/courses/112/103/112103307/
3. https://www.engineeringtoolbox.com/
4. https://www.mech4study.com/
5. https://onlinecourses.nptel.ac.in/noc24

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COURSE ID:
Course Name :PRODUCTION DRAWING
Course Code :MEH303
Course Abbreviation : HPDR

A. LEARNING SCHEME:

Scheme Components	Actual Contact Hours / week	Credits
Classroom Learning (CL)	02	4
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	04	
Self-Learning Hours (SLH)	02	
Notional Learning (NLH)	08	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
4	30	70	100	40	25	10	25@	10	25	10	175

(Total IKS Hrs for Sem: 00Hrs)

C.ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities.

D. i) RATIONALE:

Production drawing is essential for communicating ideas in manufacturing industry as well as other engineering applications. Production drawings illustrate set of instructions to manufacture a product, providing information about dimensions, materials, finishes, tools required, methods of assembly and soon. Therefore, this course has been developed for interpretation and preparation of the production drawing.

ii) INDUSTRY/EMPLOYEREXPECTED OUTCOME

Prepare production drawing of a given part/component as per requirement.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based Learning.

MEH303 -1: Interpret curves of intersection for given solids.
MEH303 -2: Construct an auxiliary view of given object.
MEH303 -3: Use convention for representation of material and mechanical components.
MEH303 -4: Draw production drawing.
MEH303 -5: Prepare assembly and detail drawing using given data.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg& service sector	PSO 2 Start entrepreneurial activity
Competency									
MEH303-1	1	2	1	-	-	-	-	1	
MEH303-2	2	2	1	-	-	-	-	1	
MEH303-3	3	3	1	-	-	-	-	2	
MEH303-4	3	3	1	-	-	-	-	2	
MEH303-5	3	2	1	-	-	-	-	2	

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Drawing Hall for Production drawing* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Draw four different Problems in Sketch Book on intersection of solids when intersecting solids are Prism with Prism, Cylinder with cylinder. when: Axes are at 90º and bisecting. Axes are at 90º and offset.	04	**MEH303 -1**
2	Draw four different Problems in Sketch Book on intersection of solids when intersecting solids are Square Prism with Cylinder, Cylinder with square prism. when: Axes are at 90º and bisecting. Axes are at 90º and offset.	04	**MEH303 -1**
	SHEET NO - 01 - Total 04 Problems (02 Problems on Sr. No. 1 and 02 problems on Sr. No. 3)	04	

3	Draw four different Problems in Sketch Book on auxiliary view - considering given other views.	04	**MEH303 -2**
4	Complete at least four given partial drawings in sketch book by considering given auxiliary and other views.	04	**MEH303 -2**
	SHEET NO - 02 - Total 04 problems (02 problems on Sr. No. 3 and 02 problems on Sr. No. 4)	04	
5	Draw in sketch book the various conventional representations as per IS SP - 46	02	**MEH303 -3**
	SHEET NO – 03 (Judicial mix by Teacher)	02	
6	Draw Dimensional and Geometrical Tolerances, Welding Symbols, Surface Roughness and Machining Symbols on the given figures.	04	**MEH303 -4**
7	Develop at least four Production drawing of machine components showing dimensional and geometrical Tolerance, surface finish etc.	04	**MEH303 -4**
	SHEET NO - 04 (Judicial mix by Teacher based on Sr. No 6 and Sr. No 7)	04	
8	Draw an Assembly drawing of at least four different machine components in sketch book, from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions	08	**MEH303 -5**
	SHEET NO - 05 (Any one machine component)	02	
9	Draw at least four detailed drawing of machine components in sketch book, from the given assembly drawing showing Conventional Representation, Dimensional and Geometrical Tolerances and Surface Finish symbols. (Other than considered for assembly drawing)	08	**MEH303 -5**
	SHEET NO - 06 (Any one machine component)	02	

Note: Out of above suggestive practicals -

- All Marked Practical are mandatory.
- **All above lab experiments are to be performed.**
- Judicial mix of above practical is to be performed to achieve desired outcomes.

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome*MEH303-1Interpret curves of intersection for given solids.*			
1.	**Intersection of Solids** 1.1 Curves of intersection of surfaces - Prism with Prism (Triangular, Square), Cylinder with cylinder. 1.2 Curves of intersection of surfaces -Square Prism with Cylinder All above types for following conditions – Axes are at 90º and bisecting. Axes are at 90º and offset.	**04**	**12**

***Course Outcome*MEH303-2** *Construct an auxiliary view of given object.*			
2.	**Auxiliary Views** Auxiliary planes and views. 2.1 Draw Auxiliary view from the given orthographic views. 2.2 Complete the partial view from the given auxiliary and Other principal view.	**04**	**10**
***Course Outcome*MEH303-3** *Use convention for representation of material and mechanical components.*			
3.	**Conventional representation** 3.1 Engineering Material Conventions 3.2 Conventional breaks in pipes, rod and shaft 3.3 Conventional representation of common features like slotted head, radial rib, knurling, serrated shaft, splined shaft, ratchet and pinion, repeated parts, square on shaft, holes on circular pitch, internal and external threads. 3.4 Conventional representation of standard parts like ball and roller bearing, gears, springs. 3.5 Pipe joints and valves 3.6 Counter sunk and counter bored holes 3.7 Tapers	**04**	**12**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome*MEH303-4Draw production drawing.*			
4.	**Production Drawing** 4.3 Limits, Fits and Tolerances: Definitions, introductions to ISO system of Tolerance. 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 basis 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 50 H7/s6, 30 H7/d9 etc. 4.4 Geometrical Tolerances: Types of geometrical tolerances, terminology for deviation, representation of geometrical tolerance on drawing. 4.5 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. 4.6 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.	**06**	**12**

***Course Outcome*MEH303-5*Prepare assembly and detail drawing using given data.**			
5.	**Assembly and Details of Machine Components** 5.1Introduction to assembly drawing, accepted norms to be observed for assembly drawings, sequence for preparing assembly drawing, Bill of Material (BOM). a) Couplings: Oldham & Universal couplings. b) Bearing: Foot Step & Pedestal Bearing. c) Lathe: Single (pillar type) and square tool Post. d) Bench vice & Pipe Vice. e) Screw-jack f) Drill Jig 5.2 Basic principles and process of dismantling the above all from "a" to "f" assemblies into components.	**12**	**24**
Total		**30**	**70**
Summative assessment – Theory paper should be such that total marks of questions on topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

Suggested List of Micro-projects

1. Prepare assembly drawing/detailed drawing of machine vice/ lathe tail stock/ tool post etc. by visiting Institute's workshop.
2. Prepare report on various types of welding symbols used for fabrication work by Visiting nearby fabrication workshop.
3. Any other micro-projects suggested by subject faculty on similar line.
4. Prepare detailed drawings of Various IC Engine components using proper measuring instruments by visiting Institute's Power engineering Lab or any other.
5. Students should collect Production drawings from nearby workshops/industries and establish item reference numbers on that drawing for convention or tolerance value. Prepare report showing item reference numbers and their meaning.
6. Prepare report representing conventional representation of various piping joints by visiting nearby process industries like sugar factory, chemical industries, water treatment plant, etc.

Note:

- Above is just a suggestive list of micro-projects and assignments; faculty must prepare their own bank of micro-projects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and may be considered for FA-PR evaluations.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Intersection of Solids	-	-	12	**12**	CO1
I/2	Auxiliary Views	-	10	-	**10**	CO2
I/3	Conventional representation	08	04	00	**12**	CO3
II/4	Production Drawing	-	04	08	**12**	CO4
II/5	Assembly & Details of Machine Components	-	08	16	**24**	CO5
TOTAL		**08**	**26**	**36**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Drawing / drafting skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Drawing / drafting skills	10
	TOTAL	**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, charts, videos available on various web sites, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Bureau of Indian Standards.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	October2003, ISBN:81-7061-091-2
2.	Bhatt N. D.	Engineering Drawing	Charotar Publishing House, 2011, ISBN: 978-93-80358-17-8
3.	Bhatt N. D. Panchal V. M	Machine Drawing	Charotar Publishing House, 2011, ISBN: 978-93-80358-11-6
4.	Narayan, K. L. Kannaiah, P. Venkata Reddy, K.	Production Drawing	NewAge International Publications, 2011, ISBN: 978-81-224-2288-7
5.	Sidheswar N. Kannaiah, P. Sastry V.V.S.	Machine Drawing	Tata McGraw Hill Education Private Ltd, New Delhi, 2011, ISBN-13: 978-0-07-460337-6

M. LEARNING WEBSITE & SOFTWARE: -

1. https://youtu.be/rerGFp3V6W8
2. https://youtu.be/599ThWCvMVA
3. https://youtu.be/5Pj7vkcolXk
4. https://youtu.be/FqzplEaE4Z0
5. https://youtu.be/VRi2LMm6jHU

*****

COURSE ID: ME
COURSE NAME : MECHANICS OF MATERIALS
COURSE CODE : MEH305
COURSE ABBREVIATION: HMOM

A. LEARNING SCHEME:

Pre-requisite Course(s): Nil

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	04	3
Tutorial Learning (TL)	00	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	00	
Notional Learning (NLH)	06	

B. ASSESSMENT SCHEME:

PAPER DURA-TION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
03	30	70	100	40	25	10	-	-	-	-	125

(Total IKS Hrs for Sem: Hrs)

C. ABBREVIATIONS: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE: -

With the preliminary understanding of forces and force systems acting on the engineering structures and their components. The focus now shifts on various actions and the corresponding strength evaluation of engineering materials under these specified actions to ascertain the suitability of materials, their size requirements. Simultaneously analytical approaches are dealt with behaviour of the materials in focus, understanding the engineering parameters of loading on these members namely shear force and bending moments for various configurations of members, support conditions and loading.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Analyse the stresses & strains in the given structural elements using relevant methods.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH305-1 Structural systems, actions and their types. Simple actions on a linear member causing deformations in the member**.**

MEH305-2 Elastic constants and their relation, strain energy for various forms of load application.

MEH305-3 Theorem of moments, M.I of single and built-up sections rectangular and circular used in Engineering applications.

MEH305-4 Engineering analysis of beams carrying transverse loading, constructing SFD and BMD for s/s and cantilever beams.

MEH305-5 Understanding pure and ordinary bending governing flexural behaviour.

MEH305-6 Understanding polar moment of inertia, torque and design of circular shafts and corner columns.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entreprene urial activity
Competency	3	2	2	2	3	1	2	2	2
MEH305-1	3	2	-	2	-	1	2	2	1
MEH305-2	3	2	1	2	-	1	2	3	1
MEH305-3	3	2	1	2	-	1	2	3	1
MEH305-4	3	2	1	3	2	1	2	2	2
MEH305-5	2	1	1	2	-	1	2	1	1
MEH305-6	2	2	1	2	-	1	2	2	2

Note: typical matrix assessment based on previous records—for continuous analysis and improvement to identify gap areas and further improvement.

F. CONTENT:

i) Practical exercises

The following exercises shall be conducted as practical work as detailed in laboratory manual for Mechanics of Materials developed by the institute in practical sessions of batches of about 20- 22 students.

Sr No	Title Of Practical Exercise	Course Outcome
1	Study of Universal Testing machine and Compression testing machine	MEH305-1
2	Tension test on mild steel rod (Fe250)	MEH305-1
3	Tension test on TOR steel or HYSD bar	MEH305-2
4	Compression test on metals –Mild steel, Aluminum and timber	MEH305-2
5	Flexure test on metal	MEH305-2
6	Shear test on metal	MEH305-2
7	Impact test on metal	MEH305-3
8	Rockwell Hardness test on metal	MEH305-4
9	Shear force and BM diagram –problems on standard cases and, cantilever and s/s beams.	MEH305-4
10	Brinell's Hardness Test	MEH305-4
11	Flexure test on timber specimen	MEH305-4
12	Torsion test on circular shaft	MEH305-5

In the list, Expt. No.1 to7 exercises are compulsory and from 8 to 12, any three exercises shall be conducted. in all 10 experiments are mandatory.

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH305-1 *Structural systems, actions and their types. Simple actions on a linear member causing deformations in the member.*			
1	**Engineering systems, actions and simple behaviour** 1.1 Engineering systems –buildings, machines, water tanks, chimney, bridges, retaining walls. 1.2 Various actions and their effect – axial tension, axial compression, flexure, torsion 1.3 Material behaviour –Elasticity, plasticity, ductility, malleability, toughness, hardness, brittleness-physical properties governing engineering design 1.3 Force characteristics, definition, force and force system-principles and laws 1.4 Simple stresses and strains- Hooke's law, linear stress, strain. 1.5 Compound bar subjected to axial loading.	8	12

Course Outcome MEH305-2 *Elastic constants and their relation, strain energy for various forms of load application.*			
2	**Elastic Constants and strain energy** 2.1 Elastic constants E, G, μ and K definition, sketches and explanation. 2.2, Relation among elastic constants. 2.3 Forms of loading and instantaneous stress produced in each form of loading –gradual, sudden and impact. 2.4 Composite section carrying load and its analysis 2.5 Temperature stress and its computation in a rigid member having single material and made of two materials.	12	12
Course Outcome MEH305-3 *Theorem of moments, M.I of single and built-up sections rectangular and circular used in Engineering applications.*			
3	**M.I. and its Engineering applications** 3.1 M. I definition; Area and mass moment of inertia. 3.2 Theorem on Moments –parallel and perpendicular axes theorems. 3.3 M. I of standard sections-square, rectangular, triangular, circle and rhombus 3.4 M. I. of built up sections – I, T and L sections.	10	10

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH305-4 *Engineering analysis of beams carrying transverse loading, constructing SFD and BMD for s/s and cantilever beams.*			
4	**Shear force and Bending Moment Diagrams** 4.1 Definition of shear force and BM at any section of a beam carrying transverse loading 4.2 Sign convention and construction of SFD and BMD for standard cases of loading on cantilevers and s/s beams (point load and UDL only). 4.3 Plotting SFD and BMD for s/s beams with overhangs carrying point load, UDL and couple.	12	14
Course Outcome MEH305-5 *Understanding pure and ordinary bending governing flexural behaviour leading to design of beams.*			
5	**Bending theory of beams** 5.1 Theory of Pure bending 5.2 Theory of ordinary bending 5.3. Flexure formula and assumptions made in its derivation. 5.4 Bending stress, section modulus and design of rectangular beams. 5.5 Shearing stress across any section –shear stress distribution and meaning of each term involved. 5.6. Shearing stress across a rectangular and a circular section.	10	12

Course Outcome MEH305-6 *Understanding polar moment of inertia, torque and design of circular shafts and corner columns.*			
6	**Torsion on Circular shafts** 6.1 Polar MI for circular section 6.2 Torsion formula for twist in a circular shaft subjected to pure torque. 6.3 Torsional section modulus and design of circular shaft from. strength criteria and twist criteria 6.4 Power transmitted by circular shaft.	8	10
Total		**30**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

- **NA**

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Engineering systems, actions and simple behaviour	4	4	4	12	**MEH305-**1
I / 2	Elastic Constants and strain energy	4	4	4	12	**MEH305-2**
I / 3	M.I. and its Engineering applications	4	2	4	10	**MEH305-3**
II /4	Shear force and Bending Moment Diagrams	4	2	8	14	**MEH305-4**
II /5	Bending theory of beams	4	4	4	12	**MEH305-5**
II / 6	Torsion on Circular shafts	4	2	4	10	**MEH305-6**
	Total Marks				**70**	

I. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Drawing / drafting skills	05
5	Drawing / drafting skills	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

1. Chalk board
2. LCD presentations
3. Simulation labs
4. Infographics charts/Virtual labs –NITK etc.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1	Elements of Strength of Materials	Timoshenko, S.P. and Young, D.H.	Affiliated East West Press Pvt. Ltd., Delhi
2	Mechanics of Materials	Adarsh Swaroop	New Age International
3	Strength of materials.	Bhavikatti, S.S.	Vikas publishing house pvt Ltd.
4	Strength of Materials	Khurmi, R.S.	S. Chand& Co., Delhi
5	Strength of Materials	Singer, F.L.	Harpe Collins Publishers India Delhi
6	Strength of materials	S Ramamurtham& Narayan	Danpat Rai
7	Mechanics of Materials, 4th Edition	Beer and Johnson	McGraw-Hill Education 2020

M. LEARNING WEBSITE & SOFTWARE: -

1. www.nptel.com/iitm/
2. www.howstuffworks.com/
3. www.vlab.com
4. https:// en.wikipedia.org/wiki/strength of materials

*****

COURSE ID:
COURSE NAME : FLUID MECHANICS AND MACHINERY (ME)
COURSE CODE : MEH306
COURSE ABBREVIATION: HFMM

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	04	03
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	06	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
03	30	70	100	40	25	10	25#	10	-	-	150

(Total IKS Hrs. for Sem: Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

The knowledge of fluid properties, fluid flow & fluid machinery is essential in many fields of engineering like in power generation, irrigation, water supply, etc. This course aims to develop the skills that will enable the students to select appropriate hydraulic devices and machines like pressure gauges, flow measuring devices, pipes, pumps, turbines, etc. for a particular application.

ii) INDUSTRY/EMPLOYEREXPECTED OUTCOME

This course will enable the students to select appropriate hydraulic machine(s) based on its application for efficient functioning

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH306-1 - Solve numerical related to properties of fluid and pressure measurements
MEH306-2 - Apply Bernoulli's theorem to various flow measuring devices like Venturimeter, orifice meter and pitottube, etc.
MEH306-3 - Calculate the various losses in flow through pipes
MEH306-4 - Select suitable hydraulic turbine and pump for the given application
MEH306-5 - Evaluate the performance of hydraulic turbines and pumps

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	PSO 2 Start entrepre neurial activity
Competency									
MEH306-1	3	1	1	1	-	-	1	1	-
MEH306-2	3	1	1	1	-	-	1		
MEH306-3	3	2	1	1	-	-	1		
MEH306-4	3	2	2	-	1	-	2		
MEH306-5	3	3	2	2	-	-	2		

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *FMM LAB for* practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	*Measurement of water pressure by using Bourdon tube pressure gauge and U-tube Manometer	02	CO1
2	Measurement of discharge of water by using a measuring tank and stopwatch (or rotameter/ flow meter).	02	CO2
3	Measurement of total energy available at different sections of a pipe layout to verify Bernoulli's theorem	02	CO2
4	*Measurement of discharge through pipe using Venturimeter/ Orifice meter	02	CO2

5	Measurement of discharge through a pipe provided with sharp edged circular orifice	02	CO2
6	Measurement of the discharge of water in open channel using Triangular/ Rectangularnotch.	02	CO2
7	Interpretation of the type of flow using Reynolds apparatus	02	CO2
8	*Calculation of Darcy's friction factor 'f' inpipes of different diameters for different discharges	02	CO3
9	*Determination of minor frictional losses in sudden expansion and sudden contraction in a pipe	02	CO3
10	Determination of minor frictional losses in elbow and bend in a pipe	02	CO3
11	Determination of the force exerted and workdone by a jet on flat plate	02	CO5
12	*Determination of overall efficiency of Pelton turbine using Pelton wheel test rig.	02	CO5
13	*Dismantling and Assembly of a Centrifugal pump	02	CO4
14	*Determination of overall efficiency of Centrifugal pump using Centrifugal pump test rig	02	CO5
15	Dismantling and Assembly of a Reciprocatingpump	02	CO4
16	*Determination of overall efficiency and percentage slip of Reciprocating pump using Reciprocating pump test rig	02	CO5

Note: '*' Marked Practicals Are mandatory. Minimum 80% of above list of lab experiment are to be performed.

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH306-1 *- Solve numerical related to properties of fluid and pressure measurements*			
1.	**Properties of Fluid and Fluid PressureMeasurement** 1.3. **Properties of Fluid**: Density, Specific gravity, Specific volume, Specific Weight, Dynamic viscosity, Kinematic viscosity, Surface tension, Capillarity, Vapor Pressure, Compressibility, Types of fluids, Simple numerical on properties of fluids. 1.4. **Fluid Pressure**: Fluid pressure, Pressure head, Pressure intensity, Pascal's law, Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure, Differentunits of pressure and their inter-relation, Simple numerical. 1.5. **Fluid Pressure Measurement Devices**: Construction and working principle of piezometer, simple and differential manometers, Micromanometers, Numerical on above	**14**	**14**

	manometers, Construction and working principle of Bourdon tube pressure gauge. 1.6. **Hydrostatics**: Total pressure, center of pressure regular surface forces on immersed bodies in liquid in horizontal and vertical position, Simple Numerical.		
Course Outcome MEH306-2 - Apply Bernoulli's theorem to various flow measuring devices like venturimeter, orifice meter and pitottube, etc.			
2	**Fundamentals of Fluid Flow and FlowMeasurement** 2.5. Types of Fluid Flows: Laminar, turbulent, steady, unsteady, uniform, non uniform, rotational, irrotational, 1-D,2-D and 3-D flows. 2.6. Continuity equation, Bernoulli's theorem. 2.7. Construction and working principle of Venturimeter, Derivation for discharge throughventurimeter and numerical on it. 2.8. Construction and working principle of Orifice meter, Derivation for discharge through Orifice meter and numerical on it. 2.9. Hydraulic coefficients (Cd, Cc, Cv). 2.10. Construction and working principle of Pitot Tube and numerical on it	**10**	**12**
***Course Outcome* MEH306-3** - Calculate the various losses in flow through pipes			
3.	**Flow through Pipes** 3.2 Laws of fluid friction for laminar and turbulent flow 3.3 Darcy's equation and Chezy's equation for calculation of frictional losses, Numerical on above equations. 3.4 Minor losses in fittings and valves (No numerical) 3.5 Hydraulic gradient line and total energy line 3.6 Hydraulic power transmission through pipes, Simple numerical 3.7 Water hammer phenomenon in pipes, causes and remedial measures	**10**	**08**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome* MEH306-4** - Select suitable hydraulic turbine and pump for the given application			
4.	**Hydraulic Turbines** 4.7 Impact of jet on fixed vertical flat plate, moving verticalflat plate, curved vanes with special reference to turbines and pumps, Numerical on above conditions. 4.8 Layout of hydroelectric power plant and function of each component, Water Storage systems used in Ancient India (IKS). 4.9 Classification of hydraulic turbines.	**14**	**20**

	4.10 Construction, working principle, velocity diagram and applications of Pelton wheel, Kaplan turbine and Francis turbine. 4.11 Draft tubes: Types and constructional details, Concept of cavitation in turbines. 4.12 Calculation of Work done, Power output, efficiency of Pelton turbine only. 4.13 Criteria for selection of hydraulic turbines and performance characteristics.		
***Course Outcome* MEH306-5** - Evaluate the performance of hydraulic turbines and pumps			
5.	**Centrifugal and Reciprocating Pumps** 5.3 Centrifugal Pumps: Water lifting devices used in Ancient India (IKS). 5.4 Classification, Construction and working principle of Centrifugal pump, Priming methods. 5.5 Types of casings and impellers. 5.6 Static head, Manometric head, NPSH, Work done, Manometric efficiency, Overall efficiency, Numerical on above parameters. 5.7 Performance Characteristics of Centrifugal pumps. 5.8 Troubleshooting, Construction, working and applications of multistage pump. 5.9 Reciprocating Pump: Construction, working principle and applications of single and double acting reciprocating pumps, Slip, Negative slip, Cavitation and Separation, Use of air vessels. 5.10 Indicator diagram with effect of acceleration head & frictional head, Pump selection criteria based on head and discharge (No numerical on reciprocating pumps)	**12**	**16**
Total		**60**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

-NA

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Properties of Fluid and Fluid PressureMeasurement	2	4	8	**14**	CO1
I/2	Fundamentals of Fluid Flow and FlowMeasurement	4	4	4	**12**	CO2

I/3	Flow through Pipes	2	2	4	**08**	CO3
II/4	Hydraulic Turbines	6	6	8	**20**	CO4, CO5
II/5	Centrifugal and Reciprocating Pumps	4	4	8	**16**	CO4, CO5
TOTAL		**18**	**20**	**32**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Drawing / drafting skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative Models.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Dr. R.K. Rajput	A Textbook of Fluid Mechanics andHydraulic Machines	S. Chand and Company Pvt.Ltd., New Delhi ISBN: 9789385401374
2.	Dr. R.K. Bansal	Fluid Mechanics and HydraulicMachines	Laxmi Publications Pvt. Ltd., New Delhi ISBN: 9788131808153
3.	Dr. P.N. Modi, Dr. S.M. Seth	Hydraulics and Fluid Mechanics including Hydraulic Machines	Standard Book House, New Delhi ISBN: 13: 9788189401269
4.	S. Ramamurtham	Hydraulic, Fluid Mechanics and FluidMachines	Dhanpat Rai Publishing Company (P) Ltd. ISBN: 9789384378271
5.	Victor Streeter, K.W. Bedford, E. Benjamin Wylie	Fluid Mechanics	McGraw-Hill Education ISBN: 9780070701403
6.	K. Subramanya	Fluid Mechanics and hydraulic Machines: Problems and Solutions	Tata McGraw-Hill Co. Ltd., New Delhi ISBN: 9789353163426
7.	R.S. Khurmi, N.	A Textbook of Hydraulics,	S. Chand and Company Pvt.

	Khurmi	Fluid Mechanics and Hydraulic Machines	Ltd., New Delhi ISBN: 9788121901628
8.	Som S.K., Biswas G.	Introduction to Fluid Mechanics and Fluid Machines	Tata McGraw-Hill Co. Ltd., New Delhi ISBN: 9780071329194
9.	Dr. Jagdish Lal	Fluid Mechanics and Hydraulic Machines	Metropolitan ISBN: 9788120004221
10	C.S.P. Ojha, P.N. Chandramouli,and R. Berndtsson	Fluid Mechanics and Machinery	Oxford University Press, New Delhi ISBN: 9780195699630
11	Raikar R.V.	Laboratory Manual Hydraulics and Hydraulic Machines	PHI Learning Pvt. Ltd., New Delhi ISBN: 9788120346642

M. LEARNING WEBSITES & PORTALS: -

1. http://www.aboutmech.com/2016/08/total-pressure-and-centre-o f-pressure.html
2. https://www.youtube.com/watch?v=UJ3-Zm1wbIQ
3. https://www.youtube.com/watch?v=_bfcdRhY7Rw
4. https://www.youtube.com/watch?v=iRdJHPFVHwM
5. https://www.youtube.com/watch?v=3zEdtkuNYLU
6. https://www.youtube.com/watch?v=Rwl1mu0TJmE
7. https://www.youtube.com/watch? v=FHTVmKdS_Lk&list=PLdoIhVhbPQ V5z6g7aT_LpC8mJb31hNiBx&index=2
8. https://www.youtube.com/watch?v=tOoBx4-ieyU&list=PLdoIhVhbPQ V5z6g7aT_LpC8mJb31hNiBx&index=3
9. https://www.youtube.com/watch?v=cpM6hF23eeQ&list=PLdoIhVhbPQ V5z6g7aT_LpC8mJb31hNiBx&index=11
10. https://www.youtube.com/watch?v=Jd5BN7SPkqI
11. https://www.youtube.com/watch?v=0p03UTgpnDU
12. https://www.youtube.com/watch?v=3BCiFeykRzo
13. https://www.youtube.com/watch?v=IiE8skW8btE
14. https://www.youtube.com/watch?v=41vb6T42_Tk
15. https://www.youtube.com/watch?v=xqGyPdxLlRg
16. https://www.energy.gov/eere/water/types-hydropower-turbines
17. https://www.realpars.com/blog/manometer#:~:text=Measuring%20pressure,The%20tube%20is&text=When%20the%20pressures%20are%20equal,side%20because%20P1%20equals%20P2
18. https://tameson.com/pages/bourdon-tube-pressure-gauge
19. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1086
20. http://ecoursesonline.iasri.res.in/course/view.php?id=27
21. https://theconstructor.org/fluid-mechanics/types-fluid-flow- pipe/38078/
22. https://www.chaitanyaproducts.com/blog/ancient-indian-water- conservation-techniques-part-1
23. https://www.youtube.com/watch?v=hQr5Op4S5q4&t=83s
24. https://www.youtube.com/watch?v=uTrajIJ79ME&t=49s

*****

COURSE ID:
COURSE NAME : BASIC ELECTRICAL & ELECTRONICS
COURSE CODE : MEH309
COURSE ABBREVIATION : HBEE

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	-	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
03	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				175
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	30	**70**	**100**	**40**	**25**	**10**	**25@**	**10**	**25**	**10**	

(TotalIKSHrsforSem.:00 Hrs)

C. ABBREVIATIONS: CL-Class Room Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self Learning Assessment
Legends: @Internal Assessment, #External Assessment, *#OnLine Examination, @$Internal Online Examination Note:

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks
5. 1(one)credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

*Self learning includes microproject/assignment/other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

The basics of Electrical and Electronic engineering are in the study of simple preliminary circuits provided with AC and D.C supplies. Students should deal with the electro-magnetic devices work on the principle of magnetism and electromagnetism. This course aims to empower mechanical engineering students with basic knowledge of electricity and its field applications related to industries. Also, it is therefore necessary for them to apply the principles of electrical and electronics engineering. This Course will make them conversant with electrical and electronic engineering aspects of manufacturing, production, fabrication, automobile and mechanical engineering-based processes in industries.

ii) INDUSTRY/EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcomes through various teaching learning experiences: Use Electrical and Electronics equipment safely in mechanical engineering applications

E. COURSE LEVEL LEARNING OUTCOMES(COS)

MEH309-1 Operate different types DC generators.
MEH309-2 Determine practically the performance characteristics of DC machines
MEH309-3 Identify the different parts along with materials of single-phase transformer
MEH309-4 Identify electronic component in electronic circuits
MEH309-5 Identify and handle semiconductor diodes and BJT.
MEH307-6 Identification and testing of logic gates.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in Mfg & service sector	PSO2 Start entrepreneurial activity
MEH309-1 Operate different types DC generators	3	-	-	1	1	-	2	1	1
MEH309-2 Determine practically the performance characteristics of DC machines	3	-	-	1	1	-	2	1	1
MEH309-3 Identify the different parts along with materials of single-phase transformer	3	-	-	1	2	-	2		
MEH309-4 Identify electronic component in electronic circuits	3	-	-	2		1		1	1
MEH309-5 Identify and handle semiconductor diodes and BJT.	3	-	-	2		1	2	1	1
MEH309-6 Identification and testing of logic gates.	3	-	-	2		1	2	1	1

F. CONTENT: -

i) Practical exercises

Sr. no	Laboratory experiences	Hrs.	CO
1	Introduction to electrical laboratory.	02	MEH309-1
2	To verify Ohms Law.	02	MEH309-1
3	Verify the relation for current and voltage/s in series resistances	02	MEH309-1
4	Verify the relation for current and voltage/s in parallel resistances	02	MEH309-1
5	Verify the Faradays law of Electromagnetic Induction	02	MEH309-1
6	Measurement of power by using ammeter, voltmeter & wattmeter	02	MEH309-2
7	Verification of relationship between line and phase values of voltage & current in STAR connection	02	MEH309-2
8	Verification of relationship between line and phase values of voltage & current in DELTA connection	02	MEH309-2
9	Identify parts of single phase Transformer.	02	MEH309-3
10	Identify parts of single phase induction motor.	02	MEH309-3
	(Any Six from above)		
11	Test different types of resistors, capacitors, inductors. - Identify different types of resistors, capacitors, inductors. - Find value of different types of resistors, capacitors, inductors.	02	MEH309-4
12	V-I characteristics of PN junction diode. - Build and test the circuit as per experimental set-up - Plot V-I characteristics	02	MEH309-5
13	Half wave rectifier - Build and test the circuit as per experimental set-up - Plot the input and output waveforms on graph.	02	MEH309-5
14	Full wave bridge rectifier - Build and test the circuit as per experimental set-up - Plot the input and output waveforms on graph.	02	MEH309-5
15	Full wave bridge rectifier with LC filter - Build and test the circuit as per experimental set-up - Plot the input and output waveforms on graph.	02	MEH309-5
16	Input and Output characteristics of BJT in common emitter configuration. - Build and test the circuit as per experimental set-up. - Plot graph of input parameters vs output parameters.	02	MEH309-5
17	Test the functionality of AND, NOT & OR logic gates using breadboard.	02	MEH309-6
18	Test the functionality of NAND & NOR logic gates using breadboard.	02	MEH309-6
	(Any Six from above)		

Note: Out of above suggestive practicals –

- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of Practicals are to be performed to achieve desired outcomes.

ii. Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH309-1: *Use electric and magnetic principles to solve electrical problems*			
1	**Introduction to elements of electric networks** 1.1 Definitions-Electric Current, Electric Potential, Potential difference, Resistance 1.2 Ohm's law 1.3 Equivalent resistance of series, parallel and combination resistance systems. 1.4 Simple numerical problems based on the above. B] Introduction to Magnetic Circuit. 1.5 Definition of magnetic flux, MMF, Magnetic force, permeability, reluctance. 1.6 Analogy between electric and magnetic circuit 1.7 Faradays laws of electromagnetic induction 1.8 Lenz law	8	10
Course Outcome MEH309-2: *Measurement of electrical quantities.*			
2	2.1 Use of Ammeter, Voltmeter, Wattmeter, Digital Energy meter, Digital Multi meter 2.2 Single phase Alternator. 2.3 A.C. Signal terms: Cycle, Frequency, Periodic time, Amplitude, RMS value, Average value, impedance, phase angle, and power factor. 2.4 Three-Phase Supply Systems 2.4 1 Phase sequence and its advantages. 2.4 2Voltage, Current and Power relation in STAR connection. (Circuit Diagram and relation statement only) 2.4.3 Voltage, Current and Power Relation in DELTA connection. (Circuit Diagram and relation statement only) 2.5 Necessity of Earthing. 2.6 IS electrical standards for safety and appliances.	10	12
Course Outcome *MEH309-3: Use of different electrical machine and transformer in Industry.*			
3	**A] Single Phase Transformer** 3.1 Principle of working 3.2 Construction of single-phase transformer. 3.3 Types of transformers- 3.3.1 According construction- core and shell type 3.3.2 According application-power transformer and distribution transformer. **B] Electrical Motors: A.C. Motors** 3.4 Basic Principle of three phase induction motor 3.5Squirrel cage and Slip ring induction rotor (Only diagram and constructional features) 3.6 Application of Squirrel cage and Slip ring induction motor 3.7 Construction of single-phase induction motor	10	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	3.8 Working of single-phase induction motor 3.9 Types of Single-phase AC motor- split phase, capacitor start, capacitor start capacitor run (Only diagram and constructional features) and its applications		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome**: MEH309-4 Identify electronic component in electronic circuits*			
4	**Electronic Components and Signals** 4.1 Electronic Components: Passive and Active components: Resistor, Capacitor, Inductor (symbols and their types) color codes (for resistor only), specifications: Maximum Voltage rating, Power rating, Tolerance and Ohmic range-For Resistor, Capacitance, Capacitor Working voltage, Insulation resistance, Power Factor (Dissipation Factor)-For Capacitor and Inductance of coil, Inductive reactance, Self Inductance and Mutual Inductance-For Inductor. 4.2 Voltage and current sources, signals: Waveform (Sinusoidal, triangular and square). 4.3 Time and frequency domain representation of signals. Amplitude, frequency, phase, wavelength.	08	8
***Course Outcome**: MEH309-5 Identify and handle semiconductor diodes and BJT.*			
5	**Diodes and Bipolar Junction Transistor** 5.1 Diodes and its Applications: P-N junction diode: symbol, construction working, V-I characteristic, and applications, Zener diode: working, symbol, V-I characteristic, voltage regulator. 5.2 Rectifiers: Half wave, Full wave Bridge rectifier Performance parameters: PIV, ripple factor, efficiency. 5.3 Filter: 5.3.1Need of filter 5.3.2 Types of filters- Shunt capacitor, Series inductor, LC Filter and CLC filter 5.4 BJT Symbol, construction, working principle (NPN only), Transistor as switch and amplifier. 5.5 Input and Output characteristics: CE configurations, Operating regions: Cut-off, saturation Active Region	16	18
***Course Outcome**: **MEH309-6** Identification and testing of logic gates.*			
6	**Digital IC** 6.1 Number system: Decimal number system, Binary Number system, Hexadecimal number system. Conversion of Decimal to Binary and Binary to Decimal. Binary addition and Subtraction (using 1's complement only).	08	10

	6.2 Gates (AND, OR, INVERTER, NAND, NOR): Pin diagram, truth table.		

** No questions will be asked on IKS learning subtopics in any question papers.

G. LIST OF ASSIGNMENTS UNDER SLA

1. Prepare a simple model of single-phase transformer.
2. Collect photographs with details of various power/ distribution transformer and identify the parts (Specification, application, cost, features, manufacturers)
3. Prepare a simple model of three phase Induction motor.
4. Prepare a simple model of single-phase Induction motor.
5. Write procedure to measure AC and DC Amplitude, time period and frequency using CRO and function generator.
6. Tabulate important characteristics of commonly available semiconductor diodes.
7. Draw a chart showing circuit diagrams of half wave and full wave rectifiers with waveforms and equations.
8. Small Hobby project using Digital IC.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Use electric and magnetic principles to solve electrical problems	4	2	2	10	MEH309-1
I / 2	Measurement of electrical quantities	4	4	4	12	MEH309-2
I / 3	Use of different electrical machine and transformer in Industry	4	4	4	12	MEH309-3
II /4	Identify electronic component in electronic circuits	4	4	-	8	MEH309-4
II /5	Identify and handle semiconductor diodes and BJT.	4	4	10	18	MEH309-5
II / 6	Identification and testing of logic gates.	4	2	4	10	MEH309-6
	Total Marks				70	

I. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	**Particulars**	**Marks out of 25**
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

At the time of Practical Examination assessed for 25 marks as per following criteria:

Sr.no	**Criteria**	**Marks allotted**
1	Knowledge about the course	05
2	Preparedness for practical /Oral	05
3	Neat& complete Diagram/write up	05
4	Observations/Handling of instrument/ Communication/Presentation	05
5	Oral Based on Lab work and completion of task	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	**Criteria**	**Marks allotted**
1	Punctuality	05
2	Presentation and dedication	05
3	Clarity and closeness on topic	05
4	Understanding	10
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Classroom practices.
3. Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L. REFERENCE BOOKS:

S.N.	Name of Book	Author	Publication
1	Electrical Technology Vol-I	Theraja B.L.	S. Chand, New Delhi, 2012 or latest
2	Basic Electrical Engineering	S Chand & Company	S Chand & Company
3	Applied Electronics	Dr R S Sedha	S Chand Technical
4	Principle of Electronics	V K Mehata	S. Chand
5	Modern Digital Electronics	R P Jain	Mc Graw Hill

M. LEARNING WEBSITE & SOFTWARE

1. www.nptel.com/iitm/
2. www.circuitglobe.com/
3. www.virtual lab.com
4. www.electric4u.com

*****

COURSE ID:
COURSE NAME : COMPUTER AIDED DRAFTING
COURSE CODE : MEH315
COURSE ABBREVIATION : HCAD

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	-	2
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	04	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	04	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	-	25	10	25#	10	-	-	50

(Total IKS Hrs for Sem: - 00 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

With the advent of technology, the process of drafting and design has transitioned from manual techniques to digital methods. The study of Computer Aided Drawing and Drafting (CADD) is representing the forefront of this evolution, providing designers with powerful tools to streamline the creation, modification, and visualization of technical drawings.

ii) INDUSTRY/EMPLOYEREXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1) Create technical drawings using CADD software accurately and efficiently according to industry standards in multidisciplinary teams

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH315-1 Use basic commands in CADD software.
MEH315-2 Draw complex 2D drawings in CADD software using draw and modify tools.
MEH315-3 Draw isometric drawings using CADD software.
MEH315-4 Use software to dimension and write text on 2D geometric entities.
MEH315-5 Plot given 2D entities using proper plotting parameters in CADD.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg& service sector	Ps 2 Start entrepre neurial activity
Competency									
MEH315-1	2	-	-	1	-	-	1	1	
MEH315-2	2	1	1	-	-	-	1	1	
MEH315-3	2	1	1	-	-	-	1	1	
MEH315-4	2	-	-	-	-	-	1	1	
MEH315-5	1	-	-	1	1	1	1	1	

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the CADD Laboratory in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	*Drawing 2-D entities like Line, Polyline, Circle, Rectangle, Polygon and Ellipse by using CADD software.	4	CO1 CO2
2	Drawing simple 2-D objects using any combination of 2 or more commands, like polygon + circle, line + circle, etc.	4	CO1 CO2
3	Drawing complex 2-D objects like pulley/gear.	4	CO1 CO2
4	*Drawing complex 2-D object like coupling/joints.	4	CO1 CO2 CO4
5	* Drawing any two problems of orthographic projections using first angle method of projection.	4	CO1 CO2 CO4

6	Drawing any two problems of orthographic projections using third angle method of projection.	4	CO1 CO2 CO4
7	* Drawing any two problems of sectional orthographic projections using First angle method of projection.	4	CO1 CO2 CO4
8	Drawing any two problems of sectional orthographic projections using third angle method of projection.	4	CO1 CO2 CO4
9	Drawing any two problems of development of solids.	4	CO1 CO2 CO4
10	Drawing any two problems on Auxiliary views.	4	CO1 CO2 CO4
11	*Drawing an assembly drawing from the given detailed drawing showing assembly dimensions, part number and bill of Material.	8	CO1 CO2 CO4
12	Drawing working drawings from given assembly drawing showing conventional representation, dimensions, geometrical tolerances and machining symbols.	8	CO1 CO2 CO4
13	Drawing isometric views of given two objects containing lines, arcs, circles, holes, ribs and slots.	8	CO1 CO3
14	*Drawing Isometric drawings from given Isometric views and dimension it.	8	CO1 CO3 CO4
15	*Prepare a template for your institute of predefined paper size with title block and institute logo.	4	CO1 CO4
16	*Plot the drawings from Sr. 3 to 13 on Paper with title block and institute logo	4	CO1 CO5
	Note: Out of above suggestive Practicals- • '*' Marked Practicals Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of Practicals are to be performed to achieve desired outcomes.		

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome **MEH315-1** Use basic commands in CADD software			
1.	**Unit-I Fundamentals of CAD Drawing** 1.1 Fundamentals of Computer Aided Drafting and its applications, Various Software for Computer Aided Drafting. 1.2 CADD Interface: Application Menu, Quick Access Toolbar, Ribbons, Info Center, Command Window, Graphical Area, Status Bar 1.3 CADD initial setting commands: Snap, grid, Ortho, Osnap, Dynamic input, Limits, Units, Lt scale, Object tracking. 1.4 Co-ordinate System- Cartesian and Polar, Absolute and Relative mode, Direct Distance Entry, UCS, WCS. 1.5 Object Selection methods- picking, window, crossing, fence, last and previous. 1.6 Opening, saving and closing a new and existing drawing.	-	-
Course Outcome **MEH315-2** Draw complex 2D drawings in CADD software using draw and modify tools.			
2.	**Unit - II Zoom, Draw, Formatting and Enquiry Commands** 2.1 Zoom Commands – all, previous, out, in, extent, Realtime, dynamic, window, pan. 2.2 Draw Command - Line, Polyline, arc, circle, rectangle, polygon, ellipse, spline, block, hatch. 2.3 Formatting commands - Layers, block, line type, line weight, color 2.4 Enquiry commands–distance, area.	-	-

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome **MEH315-3** Draw isometric drawings using CADD software.			
3.	**Unit-III Modify and Edit Commands** 3.1 Modify Command - Erase, trim, extend, copy, move, mirror, offset, fillet, chamfer, array, rotate, scale, lengthen, stretch, measure, break, divide, explode, align. 3.2 Editing Objects by Using Grips-Moving, Rotating, Scaling, Mirroring and Stretching.	-	-
Course Outcome **MEH315-*4*** Use software to dimension and write text on 2D geometric entities.			
4.	**Unit - IV Isometric Drawings, Layers, and Blocks** 4.1 Isometric drafting- Isometric grid &snap, Isometric axis & plane, Polyline, Isocircle. 4.2 Dimensioning Isometric drawings. 4.3 Text writing on Isometric drawing. 4.4 Layer, Layer properties and applications. 4.5 Blocks: create, modify and use in same file and in another file.	-	-

Course Outcome **MEH315-*5*** Plot given 2D entities using proper plotting parameters in CADD.			
5.	**Unit –V Dimensioning, Text and Plot Commands** 5.1 Dimensioning commands - Dimension styles, Dimensional Tolerances and Geometrical Tolerances, Modify dimension style. 5.2 Text commands-dtext, mtext command. 5.3 Insert table–table, table style command. 5.4 Template Drawing- Standard template, loading template, create new template. 5.5 Plotting a drawing – adding plotter/printer, page setup, plot style commands.	-	-

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

-Not Applicable

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

-Not Applicable

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Drawing / drafting skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Drawing / drafting skills	10
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Practical cum Demonstrations,
2 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr.No.	Name of Book	Author	Publication
1.	AutoCAD 2021 for Engineers & Designers, Basic & Intermediate	Prof. Sham Tickoo	Publisher: BPB Publications, 21 February 2021, ISBN-10:9389898986, ISBN-13:978-9389898989
2.	AutoCAD 2014 for Engineers Volume 1	Sankar Prasad Dey	Publisher: Vikas, 21 December 2021, ISBN-13:978- 9325983373
3.	AutoCAD 2024: A Problem- Solving Approach, Basic and Intermediate	Prof. Sham Tickoo	Dreamtech Press publication, August 20, 2023, ISBN-101640571779, ISBN-13978-1640571778
4.	Engineering Graphics with AutoCAD	Kulkarni D.M	Publisher: Prentice Hall India Learning Private Limited, 1 January 2010, ISBN-10: 8120337832, ISBN-13:978-8120337831
5.	AutoCAD2021 For Beginners	Cad folks	Publication: Kishore, 5 May 2020, ISBN-10 819419539X ISBN-13:978-8194195399
6.	AutoCAD 2024 Tutorial First Level 2D Fundamentals	Luke Jumper, Randy H. Shih	SDC Publication, June 27, 2023, ISBN-10 1630575852, ISBN:978-1-63057-585-4
7.	Engineering Graphics, AICTE Prescribed Textbook	Sharad K. Pradhan, KK Jain	Khanna Book Publishing; First Edition, 1 January 2023, ISBN-10 9391505503, ISBN-13 978-9391505509

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www.autodesk.com/learn
2. https://www.cadtutor.net/
3. https://www.cadin360.com/
4. https://ocw.mit.edu/courses/mechanical-engineering/
5. https://www.engineering.com/LearningCenter/CAD.aspx
6. https://www.youtube.com/watch?v=cmR9cfWJRUU
7. https://www.youtube.com/watch?v=QuR-VKis3jU
8. https://www.youtube.com/watch?v=IWYKfzx-M1E
9. https://www.youtube.com/watch?v=RA0O6AZewTc
10. https://www.youtube.com/playlist?list=PLYEkKxSL5Gt1hR6Jg0ZiQSlc7vn-HTd7h
11. https://www.youtube.com/watch?v=PHSmwXQriIc

*****

COURSE ID:
COURSE NAME : FUNDAMENTALS OF PYTHON PROGRAMMING
COURSE CODE : MEH320
COURSE ABBREVIATION: HFPP

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	-	1
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	02	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	-	25	10	25@	10	-	-	50

(Total IKS Hrs for Sem: 00 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Comprehension of programming languages is crucial for diploma engineering graduates, especially as they engage with various software applications in the mechanical engineering domain. Python, being easy to code, potent, and stands out as an ideal language for introducing computing and problem-solving concepts to beginners. This course enables students to write Python programs and utilize various built-in functions/methods of Python modules/libraries to solve specific problems.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

An ability to prepare python programs for solving simple engineering problems.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH320-1 Use program designing tools and IDE for python.
MEH320-2 Employ python building blocks and data types in the programming.
MEH320-3 Implement conditional and looping statements in the python programming.
MEH320-4 Implement built in functions and modules in the python programming.
MEH320-5 Use NumPy for performing operations on list and array.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entreprene urial activity
Competency									
MEH320-1	2	2	2	3	-	-	2	-	-
MEH320-2	2	2	2	3	-	-	2	-	-
MEH320-3	2	2	2	3	-	-	2	-	-
MEH320-4	2	2	2	3	-	-	2	-	-
MEH320-5	2	2	2	3	-	-	2	-	-

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Computer Laboratory for Python Programming* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Install Python IDE.	02	CO1
2	*Prepare a flow chart and algorithm for simple problem.	02	CO1
3	Write a simple program to display a simple message.(Ex: "Welcome to Python programming")	02	CO2
4	Write a simple Python program by taking user'sinput to - find the area of rectangle find the area or circle.	02	CO2
5	*Write a program to accept value of Celsius andconvert it to Fahrenheit.	02	CO2
6	Write a python program to find whether the givennumber is even or odd using if - else statement.	02	CO3
7	*Write a python program to check whether a input number is positive, negative or zero using if – elif- else statement.	02	CO3

8	Write a program to accept the three sides of a triangle to check whether the triangle is isosceles,equilateral, right angled triangle.	02	CO3
9	Write a program that allows the user to input numbers until they choose to stop, and then displaysthe count of positive, negative, and zero numbers entered (Use while loop).	02	CO3
10	*Write a python program for printing multiplicationtable of a given number using for loop. (Ex. 12x1=12 12x2=24…. 12x10=120)	02	CO3
11	*Write a Python program to demonstrate the use of different mathematical functions (Ex. ceiling, floor etc.).	02	CO4
12	*Write a python program to find mean, mode, median and standard deviation using statistics module.	02	CO4
13	Write a python program utilizing a list to display thename of a month based on a given month number.	02	CO5
14	Write a python program to add or subtract twomatrices using multidimensional list.	02	CO5
15	*Write a python program to multiply two matricesusing multidimensional list.	02	CO5
16	*Write a python program to multiply two matricesusing NumPy.	02	CO5
Note: Out of above suggestive Practicals- '*' Marked Practicals Are mandatory. Minimum 80% of above list of lab experiment are to be performed. .Judicial mix of Practicals are to be performed to achieve desired outcomes.			

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome* MEH320-1** *Use program designing tools and IDE for python.*			
1.	**Introduction to Python Programming** 1.1 Revision of Computer Components (CPU, I/Odevices) 1.2 Applications of computer and programminglanguages in Mechanical engineering domain. 1.3 Program Designing Tools: Algorithm, FlowChart. 1.4 Introduction and Features of Python: Open source, Interactive, Interpreted, Object-oriented, Platform independent etc., Installation & working of IDEs.	**08**	**16**
Course Outcome: MEH320-2 *Employ python building blocks and data types in the programming.*			
2.	**Python building blocks & data types** 2.1 Python building blocks: Identifiers, Indentation,Comments, Variables, Arithmetic and assignment operators and Expressions. 2.2 Data Types: Integers, float, complex, string andtheir declaration, data type conversion. 2.3 Accepting input from user: I/O functions 2.4 Container Types: List, tuple, set and theirdeclaration.	**08**	**18**

	2.5 Write simple python program to display 2.6 "Welcome" message.		

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome: MEH320-3 *Implement conditional and looping statements in the python programming.*			
3.	**Python operators and Control flow** 3.1 Relational and Logical operators. 3.2 Decision making statements: if, if-else, if- elif -else statements. 3.3 Looping statements: while loop, for loop,Nested loops. 3.4 Loop manipulation using continue, pass, break 3.5 statements.	**06**	**14**
Course Outcome: MEH320-4 *Implement built in functions and modules in the python programming.*			
4.	**Python functions and modules** 4.1 Functions: Use of built-in functions, data conversion functions, abs, pow, min, max, round,ceil, floor etc. 4.2 Modules: Use of built-in modules- math cmath, random and statistics. 4.3 User-defined function: Function definition, 4.4 function calling, function arguments and parameterpassing, Return statement, scope of variables.	**06**	**12**
Course Outcome: MEH320-5 *Use NumPy for performing operations on list and array.*			
5.	**List and arrays in python** 5.1 List: define list (one and multi-dimension),accessing, deleting and updating values in list. 5.2 Basic list operations: slicing, repeating,concatenation and iteration. 5.3 NumPy array: Generate NumPy arrays and 5.4 construct multidimensional arrays.	**02**	**10**
Total		**30**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

- Not Applicable

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

- Not Applicable

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Observations & computer handling skill	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Observations & computer handling skill	10
4	Oral Based on Lab work and completion of task	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Fundamentals of Python: First Programs, 2E	Kenneth A. Lambert	Cengage Learning India Private Limited,ISBN: 9789353502898
2.	Let Us Python - 6th Edition	Yashavant Kanetkar, Aditya Kanetkar	BPB Publications, ISBN: 9789355515414

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www.w3schools.com/python/
2. https://www.tutorialspoint.com/python/index.htm
3. https://www.python.org/
4. https://spoken-tutorial.org/tutorial-search/?search_foss=Pyt

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SEMESTER 4TH SCHEME AND CURRICULUM

GOVERNMENT POLYTECHNIC KOLHAPUR

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Mechanical Engineering**		
Programme Code	**: ME**	**With Effect From Academic Year**	**: 2024-25**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 15 WEEKS**
Semester	**: Fourth**	**Scheme**	**: MPECS 2023**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	THEORY OF MACHINES	HTOM	DSC	3	MEH308	-	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125
2	ENGINEERING METALLURGY	HEMT	DSC	3	MEH310	-	4	-	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
3	METROLOGY AND MEASUREMENT	HMAM	DSC	3	MEH314	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10	-	-	150
4	ADVANCED MACHINING PROCESSES	HAMP	DSC	3	MEH317	-	4	-	4	-	8	4	3	30	70	100	40	25	10	25 @	10	-	-	150
5	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	HEES	VEC	2	CCH206	-	2	-	-	2	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125
6	BASICS OF MECHATRONICS	HBOM	AEC	3	MEH318	-	-	-	2	-	2	1	-	-	-	-	-	25	10	25 @	10	-	-	50
7	CNC PROGRAMMING	HCNC	DSC	3	MEH319	-	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50
8	ESSENCE OF INDIAN CONSTITUTION	HEIC	VEC	2	CCH205	-	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50
Total						**0**	**19**		**16**	**05**	**40**	**20**	**-**	**150**	**350**	**500**	**-**	**150**	**-**	**100**	**-**	**100**	**-**	**850**

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination
Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprenti./Project. /Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE ID:
COURSE NAME : THEORY OF MACHINES
COURSE CODE : MEH308
COURSE ABBREVIATION: HTOM

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	04	03
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	00	
Notional Learning (NLH)	06	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
03	30	70	100	40	25	10	-	-	-	-	125

(Total IKS Hrs for Sem: 0Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Diploma Engineer should be able to identify and interpret various elements of machines in day-to-day life when they come across various machines in practice. In maintaining various machines, a Diploma Engineer should have sound knowledge of fundamentals of machine and mechanism. TOM subject imparts the kinematics involved in different machine elements and mechanisms like I.C. engine, cam-follower, belt-pulley, gear, flywheel etc. This course serves as a prerequisite for other courses such as Machine Design of higher semester etc.

ii) INDUSTRY/EMPLOYEREXPECTED OUTCOME

This course will enable the students to: Apply the knowledge & skills related to machine, mechanism & motions according to field applications.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH308-1 Apply knowledge and skill related to different mechanisms and its motion in given situation.
MEH308-2 Determine velocity and acceleration for given mechanism.
MEH308-3 Develop a Cam profile for given type of Follower and its motions in given situation.
MEH308-4 Select the suitable power transmission devices for the given field/industrial application.
MEH308-5 Use knowledge and skills related to balancing of masses and vibration for various applications.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg& service sector	Ps 2 Start entrepre neurial activity
Competency									
MEH308-1	3	-	-	2	-	-	2		
MEH308-2	3	2	1	-	-	-	-		
MEH308-3	3	2	3	2	-	-	1		
MEH308-4	3	2	1	2	1	-	2		
MEH308-5	3	2	1	2	2	-	1		

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *TOM LAB for* practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	*Estimation of kinematic data for mechanism available in the laboratory (any one from Group A and any one from Group B) Group A: i) Beam Engine ii) Coupling rod of Locomotive, iii) Watt's indicator mechanism. Group B: i) Reciprocating engine ii) Whitworth quick return mechanism. iii) Rotary Engine iv) Crank and slotted lever quick return Mechanism v) Hand Pump mechanism	02	CO1
2	Estimation of kinematic data for mechanism available in the laboratory (any one from Group A and any one from Group B) Group A: i) Elliptical trammel, ii) Scotch Yoke Mechanism, iii) Oldham's Coupling Group B: i) Bicycle free wheel sprocket mechanism ii) Geneva mechanism iii) Ackerman's steering gear mechanism iv) Foot operated air pump mechanism	02	CO1
3	*Degree of Freedom of given mechanism by using Kutzbach equation. (Any five mechanisms available in the Laboratory)	02	CO1
4	*Quick return mechanism used in a shaper machine	02	CO1
5	Velocity and Acceleration of four bar chain by relative velocity method. (Two Problem on A2 size Sheet.)	02	CO2
6	*Velocity and Acceleration of single slider crank chain by relative velocity method. (Two Problem on A2 size Sheet.)	02	CO2
7	*Velocity and Acceleration of Slider crank chain by Klien's Construction Method.	02	CO2
8	*Cam profile for knife edge Follower. (Two problem on A2 size sheet, at least one problem on offset follower)	02	CO3
9	Cam Profile for roller follower. (Two Problem on A2 size sheet, at least one problem on offset follower)	02	CO3
10	Measurement of follower displacement with Cam rotation for knife edge follower and roller follower	02	CO3
11	*Estimation of slip, length of belt, angle of contact in an open and cross belt drive.	02	CO4
12	Identification of gears and gear train in Lab and Machine shop.	02	CO4
13	Preparation of different Gear trains from the given gears.	02	CO4
14	Balancing of rotating unbalanced system	02	CO5

Note: '*' Marked Practicals Are mandatory. Minimum 80% of above list of lab experiment are to be performed.

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH308 -1 *Apply knowledge and skill related to different mechanisms and its motion in given situation.*			
1.	**Fundamentals and Types of Mechanism** 1.1 Kinematics of Machines: - Definition of statics, Dynamics, Kinematics, Kinetics, Kinematic link and its types, Kinematic pair and its types, constrained motion and its types 1.2 Kinematic chain (locked chain, constrained chain and unconstrained chain with equation), Degree of freedom (Kutzbach equation) 1.3 Mechanism and Inversion: Mechanism and Inversion of Mechanism, Difference between machine and structure. 1.4 Inversion of Kinematic Chain a) Inversion of four bar chain: Beam engine, Coupling rod of Locomotive, Watt's indicator mechanism. b) Inversion of single slider Crank chain: Reciprocating I.C. engine, Whitworth quick return mechanism, Rotary Engine, Oscillating cylinder engine, Crank and slotted lever quick return Mechanism, Hand Pump mechanism c) Inversion of Double Slider Crank Chain: Elliptical trammel, Scotch Yoke Mechanism, Oldham's Coupling	**14**	**18**
Course Outcome MEH308-2 *Determine velocity and acceleration for given mechanism.*			
2	**Velocity and Acceleration in Mechanism** 2.1 Concept of relative velocity and acceleration of a point on a link, Inter-relation between linear and angular velocity and acceleration. 2.2 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple Mechanisms: four bar chain and single slider crank chain (Limited up to 4 Links). 2.3 Determination of velocity and acceleration of point on link by relative velocity method (Excluding Coriolis component of acceleration) . 2.4 Klein's construction to identify velocity and acceleration of different links in single slider crank mechanism (When crank rotates with uniform velocity only).	**12**	**16**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course OutcomeMEH308-3 *Develop a Cam profile for given type of Follower and its motions in given situation.*			
3.	**Cam and Follower** 3.1 Introduction to Cams and Followers, definition and applications of Cams and Followers, Cam terminology. 3.2 Classification of Cams and Followers. 3.3 Different follower motions and their displacement diagrams - Uniform velocity, simple harmonic motion, uniform acceleration and retardation. 3.4 Drawing of profile of radial Cam with knife-edge and roller Follower with and without offset (reciprocating motion only).	**08**	**10**
Course OutcomeMEH308-4 *Select the suitable power transmission devices for the given field/industrial application*			
4.	**Power transmission (Belt, Chain and Gear)** 4.1 Belt Drive: a) Type of belts, flat belt, V-belt & its applications, material for flat and V-belt, Selection of belts b) Angle of lap, length of belt (No derivation), Slip and creep, Determination of tension ratio of tight side and slack side tension, Power transmitted by belt. (numerical on power transmission by belt) 4.2 Chain Drives: Types of chains and sprockets, Advantages & Disadvantages of chain drive over other drives (No numerical on Chain drive). 4.3 Gear Drives: a) Classification of gears, Law of gearing, Concept of Conjugate profile (Involute only) Spur gear terminology. b) Types of gear trains, Train value & velocity ratio for simple, compound, reverted and epicyclic gear trains. (No numerical on Gear drive). Comparison between Belt drive, Chain drive and Gear drive	**16**	**16**
***Course Outcome*MEH308-5** Use knowledge and skills related to balancing of masses and vibration for various applications.			
5.	**Balancing of Masses and Vibration** 5.11 Balancing of Rotating Masses: Concept of balancing: Need and types of balancing, Balancing of single rotating mass. 5.12 Analytical and Graphical methods for balancing of several masses revolving in same plane and different plane (Numerical on single plane only). 5.13 Vibration: Fundamentals of Vibration: Definition and concept of Free, Forced, Undamped, Damped vibrations. (no numerical) 5.14 Advantages and Disadvantages of Vibration, Causes and remedies of Vibration, Vibration isolators. Forced vibrations	**10**	**10**

	of longitudinal and torsional systems (Concepts only, No numerical and No derivation on vibration).		
Total		**60**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

-NOT APPLICABLE

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Fundamentals and Types of Mechanism	6	8	4	**18**	CO1
I/2	Velocity and Acceleration in Mechanism	4	8	4	**16**	CO2
II/3	Cam and Follower	2	4	4	**10**	CO3
II/4	Power transmission (Belt, Chain and Gear)	4	6	6	**16**	CO4
II/5	Balancing of Masses and Vibration	4	4	2	**10**	CO5
TOTAL		**20**	**30**	**20**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Drawing / drafting skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1	Theory Of Mechanisms and Machines	A. Ghosh, A. K. Malik	Affiliated East west press ISBN: 978-8185938936
2	Theory Of Machines	S. S. Rattan	Tata McGraw Hill Edu. New Delhi, 2010, ISBN: 978- 9353166281
3	Theory of Machines	R.S. Khurmi, J. K. Gupta	S. Chand and Company New Delhi, ISBN: 978- 8121925242
4	Theory Of Machines and Mechanisms	J. E. Shigely, J. J. Uicker	Tata McGraw Hill Edu. New Delhi, 2010, ISBN: 978- 0198062325
5	A text book of Theory of Machine	R. K. Bansal, Brar J. S.	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN: 9788170084181
6	Theory Of Machines	P. L. Ballaney	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN: 978-8174091222
7	Theory of Machines	Sadhu Singh	Pearson Education ISBN: 978-8131760697
8	Mechanical Vibrations	S.S. Rao	Pearson Education 2018 ISBN: 978-9353062569
9	Mechanical Vibration	G.K. Grover	978-8185240565

M. LEARNING WEBSITES & PORTALS: -

1. http://www.mechanalyzer.com/downloads.html
2. https://www.youtube.com/watch?v=oTcC_xXfdrA
3. https://www.youtube.com/watch?v=8shK6kbu7Xk
4. https://www.youtube.com/watch?v=yHHeicPbEzg
5. https://www.youtube.com/watch?v=yHHeicPbEzg
6. https://www.youtube.com/watch?v=Rib-_ZK8KfE
7. https://www.youtube.com/watch?v=AODiJYtxuSw
8. https://www.youtube.com/watch?v=klVYeSlxucU
9. https://www.udemy.com/course/theory-of-machines-determine-degrees-of-freedom-in-a-system/
10. https://archive.nptel.ac.in/courses/112/106/112106270/
11. https://play.google.com/store/apps/details?id=com.pinjaraimran5290.Belt_Length_Calculator&hl=en&gl=US&pli=1
12. https://psmotion.com/mechdesigner/feature/cam-design-analysis
13. https://www.vlab.co.in/broad-area-mechanical-engineering
14. https://opac.library.iitb.ac.in/

*****

COURSE ID:
COURSE NAME : ENGINEERING METALLURGY
COURSE CODE : MEH310
COURSE ABBREVIATION: HEMT

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	04	4
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	02	
Notional Learning (NLH)	08	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
03	**30**	**70**	**100**	**40**	**25**	**10**	**-**	**-**	**25**	**10**	**150**

(Total IKS Hrs for Sem: 4 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. Self learning hours shall not be reflected in the Time Table.
7. Self learning includes micro project / assignment / other activities.

D. i) RATIONALE:

Mechanical diploma technician always come across with the selection of material as per r31equirement while working in the metal working industry. It requires the knowledge of properties and composition of material. This course deals with these materials along with advanced materials, their metallurgical considerations, heat treatment processes, structure property relationship and applications. The course also includes study of iron-iron carbon equilibrium diagrams, ferrous and non ferrous metals, TTT diagram, various heat treatment processes and important non-destructive testing methods. It also covers metallurgical aspects of metals and alloys such as micro and macroscopic examination of metals and alloys. To meet current and future metal demands it is essential to get material knowledge. Materials like ferrous and non-ferrous metals, polymer, ceramics and composites are widely used in a variety of engineering applications. This course will enable diploma engineering students to identify a variety of material and their selection for various applications.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use relevant mechanical engineering materials & processes based on different applications.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

MEH310 CO1 - Select suitable material(s) based on desired properties according to application.
MEH310 CO2 - Interpret Iron-Iron carbide (Fe-Fe3C) equilibrium diagram.
MEH310 CO3 - Choose relevant alloy steel & Cast iron for mechanical components.
MEH310 CO4 - Select relevant non ferrous & powder material components for the engineering application.
MEH310 CO5 - Select relevant non metallic & Advanced material for the engineering application.
MEH310 CO6 - Use relevant heat treatment processes in given situations.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Course code	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem analysis**	**PO 3 Design/ development of solutions**	**PO 4 Engineering tools, experimentation & testing**	**PO 5 Engineering practices for society, sustainability and environment**	**PO 6 project manage -ment**	**PO 7 Life-long learning**	**PSO 1 Work in Mfg & service sector**	**Ps 2 Start entrepr eneurial activity**
Competency									
MEH310-1	3	1	-	-	-	-	1	2	1
MEH310-2	3	-	-	1	-	-	1	2	-
MEH310-3	3	-	1	-	-	-	1	1	1
MEH310-4	3	-	1	1	1	-	1	2	-
MEH310-5	3	-	1	1	1	-	1	2	-
MEH310-6	3	1	1		-	-	1	3	1

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the Laboratory in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Specimen preparation of a given material for microscopic examination	02	CO1
2	Interpretation of microstructure of steels and alloy steels using metallurgical microscope on standard specimens.	02	CO2
3	Hardness testing on Brinell Hardness tester of given sample material.	02	CO1
4	Hardness testing on Vickers Hardness tester of given sample material.	02	CO1
5	Study of Hardenability by using Jominy End quench test.	02	CO2
6	Microstructure study of cast iron using metallurgical microscope on standard specimens.	02	CO2
7	Hardness testing on relevant hardness testers of given Copper and Brass specimens.	02	CO2
8	Hardness testing on relevant hardness testers of given aluminum specimens.	02	CO2
9	Identification of different types of plastics using flame tests. .	02	CO3
10	Comparison of hardness of mild steel using quenching mediums like oil, water & brine in a muffle /box type furnace.	02	CO3
11	Comparison of hardness of alloy steel using quenching mediums like oil, water & brine in a muffle /box type furnace.	02	CO3
12	Identification of behavior of the shape-memory alloy as a function with regards to temperature using High-temperature oven or electrical current.	02	CO4
13	Conduct an industrial visit to understand and observe, various heat treatment processes, sample preparation, microstructure observation & hardness testing.	02	CO6
14	Microstructure study of copper & it's any two alloys using metallurgical microscope on standard specimens.	02	CO4
15	Comparison of Ancient Indian material development processes with recent processes. (IKS).	02	CO4

- * Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH310-1 *- Select suitable material(s) based on desired properties according to application.*			
1.	**Unit - I Structure of Metals and Basics of Engineering Materials** 1.1 Classification of engineering materials 1.2 Crystal structure, Unit cell and space lattice, Types of Crystal Systems, BCC, FCC, HCP, Packing Factor 1.3 Mechanism of Crystallization-Nuclei formation and Crystal Growth, Dendritic Structures, Microstructure 1.4 Sample preparation, etching process, types of etchants. 1.5 Properties of metals Physical Properties, Mechanical Properties. 1.6 Concept of phase, pure metal, alloy and solid solutions-types 1.7 Hardness testing procedure on Brinell, Vickers and Rockwell hardness tester. 1.8 Non-destructive Testing of Materials, Working principle, Advantages, Applications and Limitations of Radiography test, Magna Flux test, Penetrant test, Ultrasonic test, Eddy current test	**13**	**14**
Course Outcome MEH310-2 *Interpret Iron-Iron-carbide (Fe-Fe3C) equilibrium diagram.*			
2.	**Unit - II Equilibrium Diagrams** 2.1 Cooling Curves of Metals and alloys 2.2 Construction of Binary Equilibrium diagram 2.3 Phase Rule, Lever Arm Principle 2.4 Types of Equilibrium diagram – Isomorphous, Eutectic, Partial Soluble system 2.5 Reaction in Binary System –Eutectic, Peritectic, Eutectoid and Peritectoid 2.6 Iron Carbon Equilibrium diagram, various phases. Critical temperatures and significance. Reactions in Iron carbon equilibrium diagram 2.7 T-T-T Diagram, significance.	**09**	**10**

Course Outcome MEH310-3 *Choose relevant alloy steel & Cast iron for mechanical components.*			
3.	**Unit - III Steel & Cast Iron** 3.1 Broad Classification of steels. i. Plain carbon steels: Definition, Types and Properties, Compositions and applications of low, medium and high carbon steels. ii. Alloy Steels: Definition and Effects of alloying elements on properties of alloy steels. iii. Tool steels: Cold work tool steels. Hot work tool steels, High speed steels (HSS) iv. Stainless Steels: Types and Applications v. Specifications of steels 3.2 Steels for following components: Shafts, axles, Nuts, bolts, Levers, crank shafts, camshafts, Shear blades, agricultural equipment, household utensils, machine tool beds, car bodies, Antifriction bearings and Gears. 3.3 Types of cast irons - white, Gray, nodular, malleable 3.4 Specifications of cast iron. 3.5 Selection of appropriate cast iron for engineering applications. 3.6 Designation and coding (as per BIS, ASME, EN) of cast iron, plain and alloy steel. 3.7 Use of iron and steel in ancient India; Munda, Tikshna and Kanta types of iron and steels (IKS)	**09**	**10**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH310-4 Select relevant non ferrous & powder material components for the engineering application.			
4.	**Unit - IV Non Ferrous Materials & Powder Metallurgy** 4.1 Copper and its alloys - brasses, bronzes Chemical compositions, properties and Applications. 4.2 Use of copper in ancient India and its mention in Rigveda (IKS) 4.3 Aluminum alloys -Y-alloy, Hindalium, Duralium with their composition and Applications. 4.4 Bearing materials like white metals (Sn based), aluminum, bronzes. Porous, Self -lubricating bearings. 4.5 Powder Metallurgy: Introduction, Advantages, limitations and applications. Preparation of Metal Powders, Basic Steps for Powder Metallurgy	**09**	**12**

Course Outcome MEH310-5 Select relevant non metallic & Advanced material for the engineering application.			
5.	**Unit - V Non-Metallic Materials & Advanced Materials** 5.1 Polymeric Materials: i. Polymers-types, characteristics ii. Properties and uses of Thermoplastics, Thermosetting Plastics and Rubbers. iii. Thermoplastic and Thermosetting Plastic materials 5.2 Characteristics and uses of ABS, Acrylics. Nylons and Vinyls, Epoxides, Melamines and Bakerites 5.3 Rubbers: Neoprene, Butadiene, Buna and Silicons - Properties and applications. 5.4 Ceramics -types of ceramics, properties and applications of glasses and refractories 5.5 Composite Materials - properties and applications of Laminated and Fiber reinforced materials 5.6 Advanced Engineering Materials: Properties and applications of Nanomaterials and smart materials & Biomedical materials.	**09**	**12**
Course Outcome MEH310-6 *Use relevant heat treatment processes in given situations.*			
6.	**Unit - VI Heat Treatment processes** 6.1 Overview of heat treatment: Purpose, types 6.2 Annealing: Purposes of annealing, Annealing temperature range, Types and applications. 6.3 Normalizing: Purposes of Normalizing, temperature range. Broad applications of Normalizing. 6.4 Hardening: Purposes of hardening, Hardening temperature range, applications 6.5 Tempering: Purpose of tempering Types of tempering and its applications 6.6 Case hardening methods like Carburizing, Nitriding, and Cyaniding. 6.7 Heat treatment Furnaces - Muffle, Box type.	**11**	**12**
Total		**60**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

***Complete all assignments mentioned below or any one microproject or activity given by subject teacher.**

List of Assignments

Sr. No.	List of Assignment (under SLA)
1	Classification of engineering materials, their properties and applications.
2	Interpretation of Iron-Iron-carbide (Fe-Fe3C) equilibrium diagram

3	Classification, Selection and applications of various heat treatment processes.
4	Properties and applications of Advanced Engineering Materials like Nanomaterials, smart materials & Biomedical materials.
5	Heat treatment Furnaces, types and construction

Suggested List of Microprojects

1. Collect information related to Types, Properties and applications of smart materials from websites. Present the information in the form of a Chart.
2. Collect samples of various types of plastics, ceramics, composites used in day-to-day applications and prepare charts containing properties, applications of the samples.
3. Comparative study of various materials used in previous and current generation components of mechanical engineering equipment like IC Engine, Compressor, turbine, pumps, refrigerator, water cooler, Lathe Machine, Milling Machine, Drilling Machine grinding machine (any one) with proper justifications.
4. Preparation of a chart of comparison of hardness of various materials.
5. Prepare models showing various crystal structures.
6. Prepare a puzzle game on Iron-carbon Equilibrium diagram.
7. Determine the microstructure of different metallic components (minimum 5) using metallurgical Microscope and compare their microstructure in the given group.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Basics of Engineering Materials	4	4	6	**14**	CO1
I/2	Equilibrium Diagrams	2	2	6	**10**	CO2
I/3	Steel & Cast Iron	2	4	4	**10**	CO3
II/4	Non Ferrous Materials & Powder Metallurgy	4	2	6	**12**	CO4
II/5	Non Metallic Materials & Advanced Materials	2	4	6	**12**	CO5
II/6	Heat Treatment processes	2	4	6	**12**	CO6
TOTAL		16	**20**	**34**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every practical/assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Practical work and hands on skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation and dedication	05
3	Clarity and closeness on topic	05
4	Understanding	10
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Introduction to Physical Metallurgy	Avner. S. H	McGraw Hill Edu. New Delhi, 2017, ISBN. 978-0074630068
2.	Mechanical Metallurgy	Dieter. G. D	McGraw Hill Edu. New Delhi, 2017, ISBN. 978-1259064791
3.	Material Science and Metallurgy for Engineers	Kodgire, V.D., Kodgire. S. V	Everest Publishing House, 2017, ISBN. 978-8176314008
4.	Engineering Materials and Metallurgy	Rajput R.K S.	Chand and Company New Delhi,2006, ISBN 978-121927093
5.	Callister's Materials Science and Engineering	Balasubramaniam R	Wiley, New Delhi, 2014, ISBN 978- 8131518052
6.	Material Science and Metallurgy	Parashivamurthy, K. I.	Pearson Education India, 2012, ISBN. 978- 8131761625

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www.youtube.com/watch?v=jn9cP6JJ7xA
2. https://www.youtube.com/watch?v=skQRLfU3plM
3. https://www.youtube.com/watch?v=_eM49JlmFp0
4. https://www.youtube.com/watch?v=04K0bLwCDdM
5. https://vedicheritage.gov.in/vedic-heritage-in-present-context/metallurgy/
6. https://www.youtube.com/watch?v=E6oCdckcwYQ&list=PLyqSpQzTE6 M_ON8uXt-PP8uX6hMWJeYSJ&index=3
7. https://www.youtube.com/watch?v=c1ZbiBIY6Sc&list=PLxQzQgOy_J vYd32Y6XOwFOnVc4_Dkv7v6&index=38

*****

COURSE ID : ME
Course Name : METROLOGY AND MEASUREMENT
Course Code : MEH314
Course Abbreviation : HMAM

A. LEARNING SCHEME:

Scheme Component	Actual Contact Hours / Week	Credits
Classroom Learning (CL)	04	03
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	06	

B. ASSESSMENT SCHEME:

Paper Duration in Hrs	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
03	**30**	**70**	**100**	**40**	**25**	**10**	**25#**	**10**	**-**	**-**	**150**

(Total IKS Hr's for Semester: 01 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as a failure and will have to repeat and resubmit SLA work.
4. Notional learning hours for the semester are (CL+LL+TL+SL) hrs. *15 Weeks
5. 1 (one) credit is equivalent to 30 Notional hrs.

* Self learning hours shall not be reflected in the Time Table. Self-learning includes micro projects / assignments / other activities.

D. i) RATIONALE:

The Diploma Mechanical Engineer should understand the different methods and instruments which can be used for linear and angular measurements, geometrical parameters (like Surface Finish, Squareness, Parallelism, Roundness etc.) and the use of Gauges and system of Limits, Fits, Tolerances etc. are often required to be dealt in detail by Diploma Technician on the shop floor. He/she is also required to analyze, interpret and present the data collected, graphically & statistically for ensuring the quality. The knowledge of the subject also forms the basis for the design of mechanical measurements systems, design & drawing of mechanical components.

The integration of Electronics Engineering, Electrical Engineering, Computer Technology and Control Engineering with Mechanical Engineering is increasing in the industrial sector, forming a vital part in the design, manufacture and maintenance of a wide range of engineering products, processes and measurement systems. As a consequence, there is a need for Diploma Engineers to understand such systems used in measurement and automation.

ii) INDUSTRY/ EMPLOYER EXPECTED OUTCOME:

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences.

The diploma technician will be able to use relevant measuring instruments for various conditions of measurement efficiently.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S):

MEH314-1 - Select relevant linear measuring instruments for measurement.
MEH314-2 - Use different gauges and comparators for measurement of given components.
MEH314-3 -Use relevant instruments for measurement of different parameters of engineering components.
MEH314-4 - Select relevant instruments for measuring the physical parameters of the system.
MEH314-5 - Use relevant instruments for measurement of operating parameters of the system.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES/ PROGRAMME SPECIFIC OUTCOMES (CP-CO-PO/PSO) MATRIX:

[**Note: Correlation Levels:** 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": No Correlation]

Competency and Cos	Programme Outcome POs and PSO's								
	PO 1 Basic and Discipline Specific Knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of Solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project Manage-ment	PO 7 Life-long Learning	PSO 1 Work in Manufacturing & Service Sector	PSO 2 Start Entrepreneurial Activity
Competency									
MEH314.1	3	-	-	-	-	-	1	2	-
MEH314.2	3	-	1	1	-	-	1	2	1
MEH314.3	3	-	-	-	-	-	1	1	-
MEH314.4	3	-	1	1	-	-	1	2	1
MEH314.5	3	-	-	-	-	-	1	2	-

F. CONTENT:

i) Practical Exercises

The following practical exercises shall be conducted in the laboratory in practical sessions of batches of about 20- 22 students:

Sr. No.	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	*Measurement of Length and Weight by using Ancient Measurement System (IKS).	02	CO1
2	*Measurement of dimensions of component using Vernier Calliper, Vernier Height Gauge, Vernier Depth Gauge, Micrometer and inside Micrometer.	02	CO1
3	*Roundness checking of the given component using Dial Indicator / Dial Gauge.	02	CO1

4	Measurement of unknown angle of a component using Bevel Protractor and verification by Sine Bar.	02	CO1
5	Measurement of the Screw Thread Elements by using Floating Carriage Micrometer and verification by Optical Profile Projector.	02	CO2
6	Measurement of the Screw Thread Elements by using Screw thread Micrometer and verification by Optical Profile Projector.	02	CO2
7	Measurement of the Gear Tooth Elements using Gear Tooth Vernier Calliper and verification by Optical Profile Projector.	02	CO2
8	Measurement of the Surface Roughness of machined surface by using Surface Roughness Tester.	02	CO2
9	Measurement of Flatness of given component.	02	CO3
10	Measurement of the unknown angle of a given component by Autocollimator / Angle Dekkor.	02	CO3
11	Measurement of Displacement by using Linear Variable Displacement Transducer (LVDT).	02	CO3
12	Measurement of Temperature by Thermocouple and Verification by Thermometer.	02	CO4
13	*Measurement of Flow Rate of liquid by Rotameter.	02	CO4
14	Measurement of Weight by using a Load Cell.	02	CO4
15	Humidity measurement using Sling Hygrometer	02	CO5
16	*Measurement of Speed of rotating shaft by Stroboscope or inductive pick up.	02	CO5
17	Measurement of Speed of rotating shaft by Photoelectric Pick up.	02	CO5
18	Use Sound Meter to measure Sound Level of a given system.	02	CO5
19	*Industry Visit to any nearby Industry to collect information about various measuring instruments (Related to metrology and measurement).	02	CO

***Note: Out of above suggestive**

- **Minimum 12** of the above list of lab experiments are to be performed in which **05 of Metrology** and **05 of Measurement** are compulsory.
- * Marked experiments are compulsory

ii) THEORY:

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom Learning Evaluation Marks
Course Outcome MEH314-1 *- Select relevant linear measuring instrument for measurement.*			
1	**Unit - I Overview of Metrology and Linear Measurement** **1.1** Definition of Metrology, Objective and types of Metrology, Need of Inspection, Methods of Measurements. **1.2** Characteristics of Instruments – Static Characteristics: Least Count (Resolution), Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis, Dead Zone, Drift, Sensitivity, Threshold, Repeatability, Reproducibility, Linearity, Amplification, Magnification. Dynamic Characteristics: Speed of Response, Fidelity, Overshoot. **1.3** Standards: Definition and Characteristics of Line Standard, End Standard and Wavelength Standard. **1.4** Linear Measuring Instruments: Working principle of Vernier Calliper, micrometer, Height Gauge and Depth Gauge. **1.5** Types of Errors and its Sources in Measurements, Factors affecting Accuracy. **1.6** Selection of Instrument, Precautions while using an Instrument for getting higher Precision and Accuracy.	**12**	**12**
Course Outcome MEH314-2 *- Use different gauges and comparators for measurement of given components.*			
2	**Unit - II Gauges and Comparators** **2.1** Comparators: Definition, Requirement of a good comparator, Classification, Use of Comparators, Working Principle (Merits and Demerits) of Dial Indicator, Sigma Comparator and Pneumatic Comparator, Selective Assembly, Interchangeability. **2.2** Gauges: Limit Gauges. Taylor's Principle of Gauge Design, Plug, Ring Gauges, Snaps Gauges. **2.3** Slip Gauges: Wringing of Slip Gauges (simple numerical). Precautions and Accessories.	**10**	**08**
Course Outcome MEH314-3 *- Use relevant instruments for measurement of different parameters of Engineering components.*			
3	**Unit - III Angular, Screw Thread, Gear and Surface Finish Measurements** **3.1** Angle Measurement: Instruments used in Angle Measurement: Angle Gauges (No Numerical), Bevel Protractor, Sine Bar. Principle of Working of Autocollimator and Angle Dekkor. **3.2** Screw Thread Measurements: Screw thread terminology, measurement of different elements such as major diameter, minor diameter, effective diameter, pitch, thread angle. Working	**14**	**14**

	principle of Floating Carriage Micrometer, Errors in Screw Threads. **3.3** Gear Measurement: Analytical and Functional Inspection, Parkinson Gear Tester, Gear Tooth Vernier Caliper, Optical Profile Projector, Errors in Gears. **3.4** Surface Roughness Measurement: Meanings of Surface Texture and definitions, methods of surface measurement - Ra, Rz and RMS values (simple numericals), Taylors Hobsons Talysurf (2D and 3D Profiles of machined surfaces). **3.5** CMM: Introduction to Coordinate Measurement Machine (CMM) and its merits.		

SECTION – II			
Course Outcome MEH314-4 *- Select relevant instrument for measuring the physical parameters of the system.*			
4	**Unit - IV Displacement, Temperature and Flow Measurement** **4.1** Generalized measuring system and its components. **4.2** Transducers: i. Classification of Transducers- active and passive, contact and non-contact, Mechanical and Electrical, analog and digital. ii. Applications of Transducers. **4.3** Displacement Measurement: Specification, selection and application of displacement transducer, LVDT, RVDT, Potentiometer. **4.4** Temperature Measurement: i. Non-electrical methods - Bi-Metal and Liquid in glass thermometer. ii. Electrical methods- RTD, Thermistor, Thermocouple. **4.5** Flow measurement: Types of flow meters, Selection criteria for flow meters, Variable area meter- Rotameter. Anemometer - hot wire and hot film, Electromagnetic flow meter, ultrasonic flow meter.	**14**	**20**
Course Outcome MEH314-5 *- Use relevant instruments for measurement of operating parameters of the system.*			
5	**Unit - V Miscellaneous Measurements** **5.1** Acoustics Measurement: Sound characteristics - intensity, frequency, pressure, power, sound level meter. **5.2** Humidity Measurement: Hair Hygrometer. **5.3** Force Measurement: Tool Dynamometer (Mechanical type), Load cell. **5.4** Speed Measurement: Tachometers: Eddy current Drag Cup Tachometer, Contact less Electrical tachometer - Inductive Pick Up, Capacitive Pick Up and Stroboscope.	**10**	**16**
Total		**60**	**70**

Summative Assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

** No questions will be asked on IKS learning subtopics in any question papers.

G. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic No.	Name of Topic	Distribution of Marks (Level wise)			Total Marks	CO
		Remember	Understand	Apply		
I/1	Overview of Metrology and Linear Measurement	2	4	6	12	CO1
I/2	Gauges and Comparators	2	2	4	08	CO2
I/3	Angular, Screw Thread, Gear and Surface Finish Measurements	4	4	6	14	CO3
II/4	Displacement, Temperature and Flow Measurement	4	8	8	20	CO4
II/5	Miscellaneous Measurements	4	4	8	16	CO5
TOTAL		**16**	**22**	**32**	**70**	

H. ASSESSMENT CRITERIA:

i. Formative Assessment of Practical:

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks 0ut of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Practical Work and Hands on Skills	10
Affective	Discipline and Punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for Practical	05
3	Presentation	05
4	Understanding	10
TOTAL		**25**

I. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Classroom Practices.
3. Use of projector and soft material for demonstration etc.

J. TEACHING AND LEARNING RESOURCES:

1. Chalk board
2. Power Point Presentations, Question Bank and Demonstrative kits etc.
3. Audio presentations

K. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1	Engineering Metrology and Instrumentation	R. K. Rajput	S.K. Kataria and Sons ISBN:9788185749822 (2009)
2	Engineering Metrology	R. K. Jain	Khanna Publication, New Delhi, ISBN- 10:817409153X (2022)
3	Engineering Metrology and Measurement	N. V. Raghavendra and L. Krishnamurthy	Oxford University Press, New Delhi, India ISBN-13: 978-0-19-808549-2. (2013)
4	Metrology and Measurements	Anand K. Bewoor and Vinay A. Kulkarni	Tata McGraw-Hill Education Private Limited, New Delhi, India ISBN (13): 978-0-07-014000-4 (2017)
5	Mechanical and Industrial Measurements	R. K. Jain	Khanna Publication, New Delhi ISBN: 8174091912 (1995)
6	Mechanical Measurements	Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard	Pearson Prentice Hall ISBN:9780136093763 (2013)

L. LEARNING WEBSITE, SOFTWARE and VIRTUAL LAB LINKS:

1. https://onlinecourses.nptel.ac.in/noc20_me94/preview
2. https://onlinecourses.nptel.ac.in/noc23_me09/preview
3. https://www.youtube.com/watch?v=Hi7NUJdznc0
4. https://portal.coepvlab.ac.in/vlab/user/registerUser
5. https://www.digimat.in/nptel/courses/video/112106179/L33.html
6. https://www.bing.com/videos/riverview/relatedvideo?&q=videos+on+CMM+measurement+IIT&&mid=6C0843737C0E8F2019006C0843737C0E8F201900&&FORM=VRDGAR
7. https://www.bing.com/videos/riverview/relatedvideo?q=videos+on+screw+thread+measurement+IIT&&view=riverview&mmscn=mtsc&mid=9850B2C61C0872810AC19850B2C61C0872810AC1&&aps=196&FORM=VMSOVR
8. https://www.bing.com/videos/riverview/relatedvideo?&q=videos+on+displacement+measurement&&mid=53BAFCB5E8DA5553247253BAFCB5E8DA55532472&&FORM=VRDGAR

9. https://www.bing.com/videos/riverview/relatedvideo?&q=bimetallic+temperature+measurement+devices&&mid=3ADB81DF5F95342EE5B53ADB81DF5F95342EE5B5&&FORM=VRDGAR
10. https://www.bing.com/videos/riverview/relatedvideo?&q=flow+measurement+devices+rotameter&&mid=145B5C41696FC6AFF30B145B5C41696FC6AFF30B&&FORM=VRDGAR
11. https://www.bing.com/videos/riverview/relatedvideo?&q=carbon+microphone&&mid=B08AB66B421E46892B46B08AB66B421E46892B46&&FORM=VRDGAR
12. https://www.bing.com/videos/riverview/relatedvideo?&q=hair+hygrometer+working+principle&&mid=20C836F03B5418F173D620C836F03B5418F173D6&&FORM=VRDGAR

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COURSE ID : ME
COURSE NAME : ADVANCED MACHINING PROCESSES
COURSE CODE : MEH317
COURSE ABBREVIATION: HAMP

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	04	4
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	04	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	08	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
3	30	70	100	40	25	10	25@	10	-	-	150

(Total IKS Hrs for Sem: 2 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

This course is designed to elevate students' knowledge of production processes by engaging them in analyzing and evaluating various production processes. Students will progress from understanding of basic concepts to selecting appropriate production methods for specific engineering applications. The aim of this course is to increase the ability to make effective decisions in production planning and control.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select relevant production processes in different industrial/field applications.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH317-1 Use appropriate CNC machine as per given application.
MEH317-2 Prepare the component using grinding and various finishing operation.
MEH317-3 Classify, Specify and perform operation on milling machine.
MEH317-4 Produce gears using various gear manufacturing methods.
MEH317-5 Select the press and its components for various applications.
MEH317-6 Select suitable Non-Traditional machining process for given component.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entreprene urial activity
Competency									
MEH317-1	3	-	-	3	-	-	2	2	1
MEH317-2	3	2	2	3	-	-	2	2	1
MEH317-3	3	-	-	2	-	-	2	2	2
MEH317-4	3	3	2	3	-	-	2	2	2
MEH317-5	3	3	2	3	-	-	2	2	-
MEH317-6	3	-	-	2	-		2	2	-

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *workshop* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	*Identify different components of CNC machine.	06	MEH317-1
2	*Preparation of given job using Surface Grinding operation.	06	MEH317-2
3	Comparison of surface finish using Grinding machine and Lapping operation.	06	MEH317-2
4	Any one Job on gear cutting/ milling/ keyway/ grooves/ slots/ end milling.	06	MEH317-3
5	*Prepare the data Required for gear manufacturing.	04	MEH317-4
6	One job on gear blank turning, drilling & facing	06	MEH317-4
7	*Manufacturing of any one sheet metal component as per drawing.	06	MEH317-5
8	Demonstration of Jig/Fixture for different machines available in workshop.	06	MEH317-5
9	*Prepare a job using Electro discharge machining / Observe the same in an industry. (Part I)	06	MEH317-6
10	Prepare a job using Electro Chemical discharge machining /Observe the same in an industry. (Part II)	06	MEH317-6
11	*Information collection for tool sharpening in ancient India. (IKS)	02	MEH317-1 MEH317-2 MEH317-3 MEH317-4 MEH317-5 MEH317-6

Note: Out of above suggestive LLOs –

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome **MEH317-1** *Use appropriate CNC machine as per given application.*			
1.	**Fundamentals of CNC machine** 1.1 Introduction: Definition, advantages and applications of CNC 1.2 Classification of CNC: Point-to-point, continuous path, straight path, absolute and incremental co-ordinate system, open loop and closed loop control system. 1.3 Constructional elements of CNC: Machine structure Bed, slide ways, column and tables. Spindle drives Stepper motor, servo motor & hydraulic motor. Movement's actuators- re-circulating ball screw, linear motion bearings. Feedback elements- Positional and velocity feed backs. Automatic tool changer- Tool magazine, turret head. Pallet changer- Linear and rotary pallet changer. 1.4 Tooling: Indexable inserts, ISO code and nomenclature	**10**	**12**
Course Outcome **MEH317-2** *Prepare the component using grinding and various finishing operation.*			
2.	2.1 Grinding and Superfinishing 2.2 Introduction: Definition of surface finish. Significance of grinding in manufacturing. 2.3 Grinding wheels: Abrasives, Grit size, Grade structure and bond type. 2.4 Grinding wheel dressing and truing-Purpose and methods 2.5 Types of Grinding machines: Construction and working of Surface, cylindrical and Internal grinders. 2.6 Super finishing Processes: Lapping, Honing, Buffing, Polishing etc.	**10**	**12**
Course Outcome **MEH317-3** *Classify, Specify and perform operation on milling machine.*			
3	3.1 Milling Process 3.2 Classification. 3.3 Basic parts and their functions – column and knee type 3.4 Specifications of milling machines 3.5 Milling cutters, Cutter nomenclature 3.6 Types of operations: Up milling, Down milling, Plain milling, Side and face milling, Form milling, Gang milling. End milling, Face milling, T- slot milling, Slitting	**10**	**10**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome **MEH317-4** *Produce gears using various gear manufacturing methods.*			
4.	**Gear Manufacturing Methods** 4.1 Importance of gear cutting, Gear manufacturing methods. 4.2 Gear Milling: Types of milling operations for gear manufacturing, cutter selection, advantages, limitations, and applications. 4.3 Gear Shaping Process: Basics of gear shaping, tooling requirement, machining considerations, advantages, limitations, and applications. 4.4 Gear Broaching Process: Working Principle, broaches for gear teeth, applications and limitations of gear broaching. 4.5 Gear Hobbing: Working principle, equipment setup, cutting parameters, advantages, disadvantages, and applications. 4.6 Gear Finishing methods: Importance and need of gear finishing, Introduction to Gear Finishing processes like Gear grinding, Gear Honing, Gear Burnishing, Gear Lapping	**12**	**14**
Course Outcome **MEH317-*5*** *Select the press and its components for various applications.*			
5.	**Press and Accessories** 5.1 Introduction: Common sheet metals used in industry. 5.2 Presses and their classification: Mechanical, Hydraulic and Pneumatic, Selection criteria for presses (Force, Speed, Production volume and type of operation). 5.3 Press tools and dies: Components of press tool. 5.4 Jigs and Fixtures: Introduction, Types, Principles of Jigs and fixtures, Methods of location.	**8**	**10**
Course Outcome **MEH317-6** *Select suitable Non-Traditional machining process for given component.*			
6.	**Non-Traditional Machining Processes** 6.1 Need for Non-Traditional Machining processes, Limitations of conventional processes, Classification of Non-Traditional Processes, Factors considered for process selection. 6.2 Electrical Discharge Machine (EDM): Working Principle, Process parameters, applications, advantages, and disadvantages. 6.3 Ultrasonic Machining (USM): Working Principle, Process parameters, applications, advantages, and disadvantages. 6.4 Electrochemical Machining (ECM): Working Principle, Process parameters, applications, advantages, and disadvantages. 6.5 Laser Beam Machining (LBM): Working Principle, Process parameters, applications, advantages, and disadvantages.	**10**	**12**

	6.6 Rapid Prototyping (RP): Introduction, Definition Cycle and applications 6.7 Computer Integrated Manufacturing (CIM): Introduction, Components of CIM, Benefits of CIM.		
Total		**60**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA:

- NOT APPLICABLE

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Fundamentals of CNC machine	2	4	6	**12**	CO1
I/2	Grinding and Superfinishing	2	4	6	**12**	CO2
I/3	Milling Process	2	4	4	**10**	CO3
II/4	Gear Manufacturing Methods	2	4	8	**14**	CO4
II/5	Press and Accessories	2	4	4	**10**	CO5
II/6	Non-Traditional Machining Processes	4	4	4	**12**	CO6
TOTAL		**14**	**24**	**32**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Drawing / drafting skills	05
	Safety / use of proper tools	05
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Participation	05
	Safety / use of proper tools	05
	TOTAL	**25**

iii) Assessment of SLA: -

- **NOT APPLICABLE**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Manufacturing Technology Vol-2	Rao P.N.	McGraw Hill, New Delhi, ISBN: 9789353160524, July 2018, Fourth Edition
2.	Elements Of Workshop Technology Vol-2	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Media Propoters & Publisher PVT. LMT., ISBN: 978-8-185-09915-6,Jan 2010,Fifteenth Edition.
3.	Production Technology Volume- II	O. P. Khanna & Lal	Dhanpat Rai Publications ISBN: 978-81-7409-099-7,1976, Nineteenth Edition.
4.	Production Technology	Dr. P. C. Sharma	S. Chand Publications. ISBN: 978-93-550-1069-8, Dec 2006, Seventh Edition.
5.	Non-conventional Machining	P. K. Mishra	Narosa Publishing House ISBN: 978-8173191381, Jan 1997, Reprint 2018.
6.	Technology of Machine Tools	S. F. Krar, A. R. Gill, P. Smid	Tata-McGraw Hill ISBN: 9781260087932, April 2019, Eighth Edition.

7.	Fundamentals of Modern Manufacturing	Mikell P. Groover	John Wiley & Sons, Inc. ISBN: 978-1-119-47521-7, Jan 2010, Fourth Edition.
8.	Rapid Prototyping Technology	Kenneth G. Cooper	Marcel Dekker Inc. ISBN :9780824702618, Jan 2001, First Edition.

M. LEARNING WEBSITE & SOFTWARE: -

1. https://youtu.be/Oy875yOH1bc
2. https://youtu.be/q_jWWtXswxs
3. https://youtu.be/7f_LIJMpLGo
4. https://youtu.be/6doeORtYeU4
5. https://www.youtube.com/watch?v=vGPuDHCybx4
6. https://youtu.be/LI-2FZSZTB0
7. https://youtu.be/jh8852sfhpw
8. https://youtu.be/06QxjEAMrKc?list=PLwFw6Nkm8oWqFJUxiUuu5c0uHK076lz2K

*****

COURSE ID:
COURSE NAME : ENVIRONMENTAL EDUCATION AND SUSTAINABILITY
COURSE CODE : CCH206
COURSE ABBREVIATION: HEES

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	02	2
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	-	
Self-Learning Hours (SLH)	02	
Notional Learning (NLH)	04	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1.5	30	70*#	100	40	-	-	-	-	25	10	125

(Total IKS Hrs for Sem: 2 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

The survival of human beings is solely depending upon the nature. Thus, threats to the environment directly impact on existence and health of humans as well as other species. Depletion of natural resources and degradation of ecosystems is accelerated due to the growth in industrial development, population growth, and overall growth in production demand. To

address these environmental issues, awareness and participation of individuals as well as society is necessary. Environmental education and sustainability provide an integrated, and interdisciplinary approach to study the environmental systems and sustainability approach to the diploma engineers.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Resolve the relevant environmental issue through sustainable solutions

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CCH206-1 - Identify the relevant Environmental issues in specified locality.
CCH206-2 - Provide the green solution to the relevant environmental problems.
CCH206-3 - Conduct SWOT analysis of biodiversity hotspot
CCH206-4 - Apply the relevant measures to mitigate the environmental pollution.
CCH206-5 - Implement the environmental policies under the relevant legal framework.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entreprene urial activity
Competency									
CCH206-1	-	1	-	-	3	2	3		
CCH206-2	-	2	2	-	3	2	3		
CCH206-3	-	-	-	-	3	1	2		
CCH206-4	1	-	-	-	3	2	2		
CCH206-5	1	-	2	-	3	2	3		

F. CONTENT:

i) Practical exercises

- **Not Applicable**

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome CCH206-1 *Identify the relevant Environmental issues in specified locality.*			
1	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste 1.4 Impact of Climate change, Factor contributing to climate change, Concept of Sustainable development, Sustainable development Goals (SDGs), Action Plan on Climate Change in Indian perspectives Zero Carbon footprint for sustainable development, (IKS-Environment conservation in Vedic and pre-Vedic India)	**05**	**12**
Course Outcome CCH206-2 *Provide the green solution to the relevant environmental problems.*			
2	**Unit - II Sustainability and Renewable Resources** 2.1 Natural Resources: Types, importance, Causes and effects of depletion. (Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources), (IKS- Concepts of Panchmahabhuta) 2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources 2.3 Energy forms (Renewable and non- renewable) such as Thermal energy, nuclear energy, Solar energy, Wind energy, Geothermal energy, Biomass energy, Hydropower energy, biofuel Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	**06**	**16**
Course Outcome CCH206-3 *Conduct SWOT analysis of biodiversity hotspot*			
3	**Unit - III Ecosystem and Biodiversity** 3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem 3.2 Biodiversity - Definitions, Levels, Value, and loss of biodiversity 3.3 Biodiversity Assessment Initiatives in India 3.4 SWOT analysis of biodiversity hot spot in India Conservations of biodiversity - objects, and laws for conservation of biodiversity	**05**	**12**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome CCH206-4 *Apply the relevant measures to mitigate the environmental pollution.*			
4	**Unit - IV Environmental Pollution** 4.1 Definition of pollution, types- Natural & Artificial (Man-made) 4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation 4.3 Water Pollution - sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards for domestic potable water, water conservation 4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area 4.5 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities	**10**	**20**
Course Outcome CCH206-5 *Implement the environmental policies under the relevant legal framework.*			
5	**Unit – V- Environmental legislation and sustainable** practices 5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts 5.2 Public awareness about environment. Need of public awareness and individuals' participation. Role of NGOs 5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging Role of information technology in environment protection and human health	**4**	**10**
Total		**30**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA:

Assignment

1. Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution
2. Draft an article on India's Strategies to progress across the Sustainable Development Goals

3. Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each source
4. Conduct the SWOT analysis of biodiversity hotspot in India
5. Prepare a mind-mapping for the zero-carbon footprint process of your field
6. Prepare a chart showing sources of pollution (air/water/ soil), its effect on human beings, and remedial actions Any other assignment on relevant topic related to the course suggested by the facilitator

UNICEF Certification(s)

Students may complete the self-paced course launched by Youth Leadership for climate Exchange under UNICEF program on portal www.mahayouthnet.in . The course encompasses five Modules in the form of Units as given below:

Unit 1: Living with climate change
Unit 2: Water Management and Climate Action
Unit 3: Energy Management and Climate Action
Unit 4: Waste Management and Climate Action
Unit 5: Bio-cultural Diversity and Climate Action

If students complete all the five Units, they are not required to undertake any other assignment /Microproject/activities specified in the course. These units will suffice to their evaluations under SLA component

Micro project

1. Technical analysis of nearby commercial RO plant.
2. Comparative study of different filters used in Household water filtration unit
3. Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainability and cost-benefit
4. IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion
5. Visit a local polluted water source and make a report mentioning causes of pollution Any other activity / relevant topic related to the course suggested by the facilitator.

Activities

1. Prepare a report on the working and functions of the PUC Center machines and its relevance in pollution control. Prepare and analyse a case study on any polluted city of India
2. Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority
3. Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers
4. Visit any functional hall/cultural hall /community hall to study the disposal techniques of kitchen waste and prepare a report suggesting sustainable waste management tool
5. Watch a video related to air pollution in India and present the summary
6. Any other assignment on relevant topic related to the course suggested by the facilitator

Note:

Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
If a microproject is assigned, it is expected to be completed as a group activity.
SLA marks shall be awarded as per the continuous assessment record.
If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section/ Topic no.	Name of topic	Distribution of marks (level wise)			Total marks
		Remember	Understand	Apply	
I/1	Environment and climate change	04	04	04	12
I/2	Sustainability and Renewable Resources	04	04	08	16
I/3	Ecosystem and Biodiversity	04	04	04	12
II/4	Environmental Pollution	04	08	08	20
II/5	Environmental legislation and sustainable practices	04	04	02	10
		20	**24**	**26**	**70**

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

- NOT APPLICABLE

ii) Summative Assessment of Practical:

- NOT APPLICABLE

Assessment of SLA: -

Every assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	10
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Participation	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1	Environmental Science	Y. K. Singh	New Age International Publishers, 2006, ISBN: 81- 224-2330-2
2	Environmental Studies	Erach Bharucha	University Grants Commission, New Delhi
3	Environmental Studies: From Crisis to Cure.	Rajagopalan R.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	A text book of Environmental Science	Shashi Chawla	Tata Mc Graw-Hill New Delhi
5	A Text Book of Environmental science	Arvind Kumar	APH Publishing New Delhi (ISBN 978-8176485906)

M. LEARNING WEBSITE & SOFTWARE: -

1. https://sdgs.un.org/goals
2. http://www.greenbeltmovement.org/news-and-events/blog
3. http://www.greenbeltmovement.org/what-we-do/tree-planting- for-watersheds
4. https://www.youtube.com/@ierekcompany/videos
5. www.mahayouthnet.in

*****

COURSE ID:
COURSE NAME : BASICS OF MECHATRONICS
COURSE CODE : MEH318
COURSE ABBREVIATION: HBOM

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	-	1
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	02	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	-	25	10	25@	10	-	-	50

(Total IKS Hrs for Sem: 4 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Mechanical diploma engineer has to work on various multidisciplinary systems under the umbrella of Mechatronics. The goal of the course is to develop an understanding of basic elements underlying mechatronics systems viz. sensors, actuators, PLC, and control software etc.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use appropriate sensors, actuators and controller for given mechatronics system(s).

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

MEH318 CO1 -Identify basic elements of mechatronics/ IoT system such as sensors, actuators, controllers etc.
MEH318CO2 - Use sensors for different mechatronics/ IoT systems
MEH318CO3 - Use actuators for different mechatronics/ IoT systems
MEH318CO4 - Develop PLC program for various mechatronics systems
MEH318CO5 - Use microcontroller for different mechatronics systems

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES/PROGRAMME SPECIFIC OUTCOMES (CP-CO-PO/PSO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	PSO 2 Start entrepre neurial activity
Competency									
MEH318-1	3	-	3	3	1	-	3	2	1
MEH318-2	3	-	2	2	1	-	2	2	1
MEH318-3	3	-	2	2	1	-	2	2	1
MEH318-4	3	-	2	2	1	-	2	2	1
MEH318-5	3	-	2	2	1	-	2	2	1

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the mechatronics *Laboratory* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Identification of Sensors, actuators available in the laboratory (IoT Lab)	02	CO1

2	*Identification of PLC and microcontroller available in the laboratory	02	CO1
3	Control LED using push button (IoT Lab)	02	CO1 CO2 CO3
4	Analyze Object Detection Using IR Sensor (IoT Lab)	02	CO1 CO2 CO3
5	Build the IOT Home Security Solution using IR, Camera and Buzzer (IoT Lab)	02	CO1 CO2 CO3
6	*Development of Ladder diagram and program PLC for simple application using sensor and actuator	02	CO1 CO2 CO3 CO4
7	*Verification of Logic gate functions for the given Ladder diagram by using PLC	02	CO4
8	*Development of Ladder diagram and program PLC for Timers and Counters	02	CO4
9	Development of Ladder diagram and program PLC for water level control	02	CO1 CO2 CO3 CO4
10	Development of Ladder diagram and program PLC for pedestrian light (green/red) toggle control	02	CO1 CO2 CO3 CO4
11	*Development of Ladder diagram and program PLC for on/off temperature control.	02	CO1 CO2 CO3 CO4
12	Development of Ladder diagram and program PLC for lift/ elevator control	02	CO1 CO2 CO3 CO4
13	Development of Ladder diagram and program PLC for single acting/double acting pneumatic system	02	CO1 CO2 CO3 CO4
14	Development of Ladder diagram and program PLC for door open and close application	02	CO1 CO2 CO3 CO4
15	*Development of Ladder diagram and program PLC for material rejection system	02	CO1 CO2 CO3 CO4

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH318-1 *- Identify basic elements of mechatronics/ IoT system such as sensors, actuators, controllers* etc.			
1.	**Fundamental of Mechatronics** 1.1 Introduction: Definition of Mechatronics, Mechatronics in Manufacturing products 1.2 Comparison between Traditional and Mechatronics approach 1.3 Block diagram representation of General Mechatronics system showing various components with suitable example	-	-
Course Outcome **MEH318-2** *Use sensors for different mechatronics/ IoT systems.*			
2.	**Sensors and Transducers** 2.1 Sensors and transducers: Definition, difference, classification 2.2 Thermal, optical, electric sensors 2.3 Transducers: Need of transducers, types of transducers: primary, secondary, active, passive, analog and Digital 2.4 Selection criteria of sensor and transducer	-	-

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome **MEH318-3** *Use actuators for different mechatronics/ IoT systems.*			
3.	**Actuators** 3.1 Introduction and Classification of Actuators Need and Scope 3.2 Pneumatic Actuation system: Single and Double acting actuators 3.3 Hydraulic Actuation system: Single and Double acting actuators 3.4 Electric Actuation system: Solenoid, relay, stepper motors	-	-
Course Outcome **MEH318-** ***4*** Develop PLC program for various mechatronics systems.			
4.	**Programmable Logic Controller (PLC)** 4.1 Introduction, definition, PLC block diagram, Manufacturers of PLC 4.2 Power supply, Input/output modules 4.3 Ladder logic symbols 4.4 Basic PLC Ladder logic programming, timers, counters	-	-

Course Outcome* MEH318-*5 Use microcontroller for different mechatronics systems.			
5.	**Microcontroller** 5.1 Comparison of Microprocessor and Microcontroller 5.2 Introduction, architecture, I/O ports 5.3 Interfacing of steeper motor, relay	-	-
Total		-	-
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA NOT APPLICABLE

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION: NOT APPLICABLE

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every practical shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Neat & complete Drawing	05
4	Safety / use of proper tools	10
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1	Mechatronics	Bolton, W	Pearson Education, New Delhi, 2017,
2	Programmable Logic Controllers	Petruzella, F. D.	Tata McGraw Hill, New Delhi, 2024,
3	Introduction to Instrumentation and Control	Ghosh, A. K.	Prentice Hall of India, New Delhi, 2004,
4	Pneumatics systems Principles and maintenance	Majumdar, S.R.	Tata McGraw Hill, New Delhi,2013,
5	Oil Hydraulic system-Principle and maintenance	Majumdar, S.R.	Tata McGraw Hill, New Delhi,2013,
6	A Textbook of Mechatronics	Rajput, R. K.	S. Chand and Company New Delhi, 2022,

M. LEARNING WEBSITE & SOFTWARE: -

1. Link / Portal Description 1 https://www.youtube.com/watch? v=J_KoRp8SnoE&t=14s
2. https://www.youtube.com/watch?v=UrST 2yu8zQ Lecture 1
3. https://www.youtube.com/watch?v=YlmRa 9zDF8
4. https://www.youtube.com/watch? v=1lbdwPfFegY
5. https://www.youtube.com/watch? v=5q7YasmwXCs&t=377s
6. https://www.youtube.com/watch?v= MLGr1_Fw0c&t=121s
7. https://www.youtube.com/watch? v=eyqwLiowZi
8. https://www.youtube.com/watch?v=qQoHQ0b d1

*****

COURSE ID
COURSE NAME : CNC PROGRAMMING
COURSE CODE : MEH319
COURSE ABBREVIATION: HCNC

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	-	2
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	04	
Self-Learning Hours (SLH)	-	
Notional Learning (NLH)	04	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL				Based on Self Learning		Total Marks
					Practical						
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	-	**25**	**10**	**25#**	**10**	-	-	**50**

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Today's manufacturing needs like productivity, accuracy, consistency, flexibility, quality and finally performance of the product is prime importance. The course will impart knowledge & skills necessary for working in modern manufacturing demands. This course will help the student to operate CNC machines for manufacturing various jobs as per need of industry requirements.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop CNC program to manufacture different industrial components using CNC machines.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S) (TNR 14)

MEH319-1 Develop manual part program for CNC lathe and milling machine.
MEH319-2 Simulate the part program using simulation software.
MEH319-3 Produce job on CNC lathe and milling machine.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepre neurial activity
Competency									
MEH319-1	3	2	2	2	-	-	3	2	
MEH319-2	3	2	-	2	-	-	3	2	1
MEH319-3	3	-	-	2	-	-	3	1	

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *CNC lab/Computer lab for CNC Programming* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Introduction of CNC machine, control panel, home position, tool selection, chuck setting and tool offsetting.	04	CO1
2	Facing operation on CNC lathe by Linear interpolation function.	04	CO1
3	Verify part program of linear interpolation function prepared in PracticalNo.2 by using suitable simulation software.	04	CO2
4	Execution of part program prepared in practical No.2 on CNC lathe machine.	04	CO3

5	Slotting operation on CNC milling byLinear interpolation function.	04	CO1
6	Verify part program of linear interpolation function prepared in Practical No.5 by using suitable simulation software	04	CO2
7	Execution of part program prepared in Practical No.5 on CNC milling machine	04	CO3
8	Circular path operation on CNC lathe bycircular interpolation function.	04	CO3
9	Verify part program of circular interpolation function prepared in Practical No.8 by using suitable simulation software	04	CO2
10	Execution of part program prepared inPractical No.8 on CNC lathe machine.	04	CO1
11	Circular path operation on CNC millingby circular interpolation function	04	CO1
12	Execution of part program prepared in Practical No.11 on CNC milling machine.	04	CO1
13	Facing, step and taper turning operation bycanned cycle.	04	CO2
14	Execution of part program prepared in Practical No.13 on CNC lathe machine.	04	CO3
15	Slotting operation on CNC milling bysubroutine call.	04	CO3
16	Verify part program of subroutine callprepared in Practical No.15 by using suitable simulation software.	04	CO2

Note: Out of above suggestive LLOs –

1. '*' Marked Practicals (LLOs) Are mandatory.
2. Minimum 80% of above list of lab experiment are to be performed.
3. Judicial mix of LLOs is to be performed to achieve desired outcomes.

ii) THEORY

Sr. No	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH319-1 *Develop manual part program for CNC lathe and milling machine.*			
1	**Unit - I Fundamentals of CNC programming** 1.1 Definition- program, programmer and programming. 1.2 Axes identification and nomenclature for CNC lathe and CNC milling machines. 1.3 Concept of tool offsetting and presetting. 1.4 Terminology used for program in Word Address Format (WAF). 1.5 Stepwise procedure for programming- study the givenpart drawing, set of instructions to the machine, problem definition, sequence of machining operation and process	-	-

	sheet, decide- material & stock size, work zero, unit, coordinate system (Absolute & Incremental), tool, cutting parameters and coordinate points.		
Course Outcome MEH319-2 *Simulate the part program using simulation software.*			
2	**Unit - II Linear & circular path programming** 2.1 Concept- Linear, circular path operations in lathe and milling machine. 2.2 Calculation of Cutting parameters, address parameters I,J, K, co-ordinates. 2.3 Respective G and M codes. 2.4 CNC part program as per given job drawing. 2.5 Concept of simulation and DRY-Run test.	-	-
Course Outcome MEH319-3 *Produce job on CNC lathe and milling machine.*			
3	**Unit - III Canned & Sub-routine call programming** 3.1 Concept- canned cycle, subroutine call. 3.2 Facing, step and taper turning canned cycle, respective G& M codes, procedure to write canned cycle program, its importance. 3.3 Concept of sub-routine call, respective G & M code, procedure of sub-routine calls to write program, its importance.	-	-

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING):

-NOT APPLICABLE

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION: NOT APPLICABLE

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Part program	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	DRY run and simulation on software	05
4	Program Execution on CNC	10
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

Demonstrations on CNC machine.

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	CNC Fundamentals and Programming	P. M. Agrawal and V. J. Patel	Charotar Publishing House Pvt. Limited. ISBN:9788185594989, Edition-2009
2.	Basics of CNC Programming	Pawan Negi, Mangey Ram, Om Prakash Yadav	River Publishers.ISBN:9781000792911, Edition-2022
3.	CNC Programming for Machining	Kaushik Kumar, Chikesh Ranjan, J. Paulo Davim	Springer International Publishing.ISBN:9783030412791, Edition-2020.
4.	CNC Programming Made Easy	Binit Kumar Jha	Vikas Publishing House. ISBN: 9788125911807, Edition- 2003
5.	CAD/CAM Theory and Practice	Ibrahim Zeid	McGraw Hill Education.ISBN:0070151342, Edition- 2009
6.	CNC Machines	Pabla B. S. & M. Adithan	New Age International Private Limited.ISBN:978- 9388818445, Edition-2023.

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www.autodesk.in/solutions/cnc-programming
2. https://www.fanucamerica.com/products/cnc/cnc-software/programming-simulation-software
3. https://www.cnccookbook.com/cnc-programming-g-code/
4. https://summitmt.com/cnc-programming/

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COURSE ID: ME
COURSE NAME : ESSENCE OF INDIAN CONSTITUTION
COURSE CODE : CCH205
COURSE ABBREVIATION: HEIC

A. LEARNING SCHEME:

Pre-requisite Course(s): Nil

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	01	1
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	-	
Self-Learning Hours (SLH)	01	
Notional Learning (NLH)	02	

B. ASSESSMENT SCHEME:

PAPER DURA-TION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
-	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
	-	-	-	-	-	-	-	-	50	20	50

(Total IKS Hrs for Sem: 4 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome – Abide by the Constitution in their personal and professional life.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CCH205-1 - List salient features and characteristics of the constitution of India.
CCH205-2 - Follow fundamental rights and duties as responsible citizen and engineer of the country.
CCH205-3 - Analyze major constitutional amendments in the constitution.
CCH205-4 - Follow procedure to cast vote using voter-id.
CCH205-5 - List the roles and responsibilities of State Election Commission towards peoples in the state.
CCH205-6 - List Judiciary provisions for the peoples in general

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	PSO2 Start entrepre neurial activity
Competency									
CCH205-1	1	-	-	-	2	-	-		
CCH205-2	1	-	-	-	2	-	-		
CCH205-3	1	2	-	-	2	-	1		
CCH205-4	-	-	-	1	-	-	-		
CCH205-5	-	-	-	-	1	-	-		
CCH205-6	1	-	-	-	1	-	-		

F. CONTENT:

i) Practical exercises – Not Applicable

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Course Outcome CCH205-1 *List salient features and characteristics of the constitution of India.*		
1	**CCH 307. 1. The Constitution: -** 1.1 Introduction. 1.2 The History of making of the Indian Constitution. 1.3 Basic structure and its interpretation. 1.4 Fundamental Rights and Duties and their interpretation	**2**	**-**
	Course Outcome CCH205-2 *Follow fundamental rights and duties as responsible citizen and engineer of the country.*		
2	**CCH 307. 2. Union Government** 2.1 Structure of the Indian Union. 2.2 President –Role and power. 2.3 Prime minister and council of ministers. 2.4 Lok Sabha and Rajya Sabha. 2.5 Union Territories and their limitations.	**3**	**-**
	Course Outcome CCH205-3 *Analyze major constitutional amendments in the constitution.*		
3	**CCH 307. 3. State Government.** 3.1 Governor –Role and power. 3.2 Chief Minster and council of ministers. 3.3 State secretariat. 3.4 Administrative Regions of Maharashtra.	**3**	**-**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	Course Outcome CCH205-4 *Follow procedure to cast vote using voter-id.*		
4	**Local Administration: -Their roles and responsibilities** 4.1 District Administration. 4.2 Municipal Corporation. 4.3 Zilla Panchayat 4.4 Taluka (Tehsil) Administration.	**2**	**-**
	Course Outcome CCH205-5 *List the roles and responsibilities of State Election Commission towards peoples in the state.*		

5	**Election Commission.** 5.1 Role and functioning. 5.2 Chief Election Commissioner –Appointment. 5.3 State Election Commission. 5.4 Elections and duties of government /Non government servants – introduction	**2**	**-**
***Course Outcome* CCH205-6** List Judiciary provisions for the peoples in general			
6	**Introduction to Judiciary Provisions: -** 6.1 Introduction 6.2 Different courts. 6.3 Government legal advisor-provisions. 6. Limitations of courts and co-ordination with home department.	**3**	**-**
Total		**30**	**-**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

1. Outline the procedure to submit application for Voter-id
2. Assignments are to be provided by the course teacher in line with the targeted COs.
3. Prepare an essay on Constitution of India.
4. Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA

List of Assignments

[Assignments are to be provided by the course teacher in line with the targeted COs.

1. Prepare an essay on Constitution of India.
2. Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA
3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies.]

Micro project: -

Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country

1. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
2. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

1. Differences in the ideals of social democracy and Political democracy.
2. Democracy and Women's Political Participation in India.
3. Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
4. Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

- Art 356 and its working in Post-Independent India.
- Women's Reservation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model?

Activity

Arrange Mock Parliament debates.
Prepare collage/posters on current constitutional issues.

1. National (Art 352) & State Emergencies (Art 356) declared in India.
2. Seven fundamental rights.
3. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Constitution and Preamble	0	0	0	0	CO1
I/2	Fundamental Rights and Directive Principles	0	0	0	0	CO2
II/3	Governance and Amendments	0	0	0	0	CO3
II/4	Electoral Literacy and Voter's Education	0	0	0	0	CO4
II/5						CO5
TOTAL			**0**	**0**	**0**	

I. ASSESSMENT CRITERIA

i) **Formative Assessment of Practical: -**
- **Not Applicable**

ii) Summative Assessment of Practical:
- **Not Applicable**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	10
2	Presentation of work	10
3	Discipline and punctuality	05
TOTAL		**25**

J. Instructional Methods:

i) Lectures cum Demonstrations,
ii) Class room practices.
iii) Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, Power Point presentations.

L. Reference Books:

Sr. No.	Name of Book	Author	Publication
1.	The Constitution of India	P. M. Bakshi	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2.	Introduction to Indian Constitution	D. D. Basu	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3.	Introduction to Constitution of India	B. K. Sharma	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197
4.	Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal.	MORE READS:	Extra Read
5.	The Constitution of India	B.L. Fadia	Sahitya Bhawan, Agra, 2017, ISBN:8193413768

M. LEARNING WEBSITE & SOFTWARE: -

1. http://www.legislative.gov.in/constitution-of-india
2. https://en.wikipedia.org/wiki/Constitution_of_India
3. https://www.india.gov.in/my-government/constitution-india
4. https://www.toppr.com/guides/civics/the-indian-constitution/ the-constitution-of-india/
5. https://main.sci.gov.in/constitution
6. https://legalaffairs.gov.in/sites/default/files/chapter%203. pdf
7. https://www.concourt.am/armenian/legal_resources/world_const itutions/constit/india/india-e.htm
8. https://constitutionnet.org/vl/item/basic-structure-indian-c onstitution

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SEMESTER 5TH SCHEME AND CURRICULUM

GOVERNMENT POLYTECHNIC KOLHAPUR			
Learning and Assessment Scheme for Post S.S.C Diploma Courses			
Programme Name	**: Diploma In Mechanical Engineering**		
Programme Code	**: ME**	**With Effect From Academic Year**	**: 2025-26**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS/ 8 WEEKS/ 6 WEEKS**
Semester	**: Fifth**	**Scheme**	**: MPECS 2023**

Sr No	Course Title	Abbreviation	Course Type	level	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Credits (Round Off)	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Activity / Assignment /Micro Project)	Notional Learning Hours /Week			Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																			Practical							
							CL	TL	LL						FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
															Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	INTERNSHIP (16 WEEKS)	HINP	INP	5	CCH505	16 WEEKS TRAINING						10.0	10						100	40	100#	40			200
	Duration - 8 weeks (Online 28 July, 2025 to 19 September, 2025)																									
2	INDUSTRIAL ORGANIZATION AND MANAGEMENT	HIOM	VEC	5	CCH502	-	5*	-	-	1	6	1.6	2	1	15*#	35*#	50	20	-	-	-	-	50	20	100
3	ENTREPRENEURSHIP AND STARTUPS	HESU	AEC	5	CCH501		2*	–	-	1	3	0.8	1	-	-	-	-	-			-	-	50	20	50
4	PROJECT	HPRJ	AEEEC	5	MEH513	-	-	-	2	2	4	1.1	1								50#	20	50	20	100
	Duration - 6 weeks (Offline 22 September, 2025 to 01 November, 2025)																									
5	POWER ENGINEERING	HPER	DSC	4	MEH401	-	8	-	4	2	14	2.8	3	3	30	70	100	40	25	10	25#	10	25	10	175
6	INDUSTRIAL HYDRAULICS AND PNEUMATICS	HIHP	DSC	5	MEH507	-	8	-	4	2	14	2.8	3	3	30	70	100	40	25	10	25#	10	25	10	175
Total						**-**	**23**		**10**	**8**	**41**		**20**		**75**	**175**	**250**		**150**		**200**		**200**		**800**

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination
Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprentice. /Project. /Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE ID :
COURSE NAME : INTERNSHIP (16 WEEKS)
COURSE CODE : CCH505
COURSE ABBREVIATION: HINP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	**10**
	Tutorial Learning		
	Laboratory Learning		
	SLH-Self Learning		
	NLH-Notional Learning		

B. ASSESSMENT SCHEME: -

PAPER DURATION	**THEORY**				**BASED ON LL&TL**				**BASED ON SLA**		**TOTAL**
					Practical						
NIL	**FA- TH**	**SA- TH**	**TOTAL**		**FA -PR**		**SA-PR**		**MAX**	**MIN**	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			200
	-	-	-	-	100	40	100#	40	-	-	

(Total IKS Hrs. for Sem.: 00 Hrs.)

Note: Students have to register for Internship with the help of Govt. agency such as BOAT (Board of Apprenticeship Training. *Students have to register* Credits for Industrial Training are in-line of guidelines of NCrF ; The industrial training is of 16 weeks considering 36-40 hours per week engagement of students (as per Guidlines of GR of Maharashtra Govt.) Under Self Learning With guidance of industry supervisor / Mentor.

C. ABBREVIATIONS: -

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge systems, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# on Line Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities

D. i) RATIONALE: -

Globalization has prompted organizations to encourage skilled and innovative workforce. Internships are educational and career development opportunities, providing practical/ hands-on experience in a field or discipline. Summer internship is an opportunity for students to get accustomed to modern industry practices, apply the knowledge and skills they've acquired in the classroom to real-world situations and become familiar with industry environments before they enter the professional world. Keeping this in mind, industrial training is incorporated to all diploma programmes as it enables the student to get equipped with practical skills, soft skills and life skills

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Apply skills and practices to industrial processes.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CCH505.1 - Observe time/resource management and industrial safety aspects.

CCH505.2 - Acquire professional experience of industry environment.

CCH505.3 - Prepare report of assigned activities and accomplishments.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-":no correlation**]**

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem analysis**	**PO 3 design/ development of solutions**	**PO 4 Engineering Tools, experimentation and testing**	**PO 5 Engineering practice for society, sustainability and environment**	**PO 6 Project management**	**PO 7 Life- long learning**	**PSO1**	**PSO2**
Competency:	2	-	-	-	-	3	-	**1**	**2**
CCH505.1	2	-	-	1	-	1	1	**1**	**2**
CCH505.2	2	-	1	1	-	2	1	**1**	**2**
CCH505.3	1	-	-	2	-	2	-	**1**	**2**

F. GENERAL GUIDELINES FOR ORGANIZING INDUSTRIAL TRAINING

The industry /organization selected for Industrial training/ internships shall be Government /Public Limited / Private limited / Startup /Centre of Excellence/ Skill Centers/ Skill Parks etc.

Duration of Training - 16 weeks students engagement time

Period of Time slot - Between 4th and 5th semester (16 weeks) i.e. commencement of internships will be immediately following the 4th semester exams.

Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

G. ROLE(S) OF DEPARTMENT AT THE INSTITUTE:

Following activities are expected to be performed by the concerned department at the Polytechnics.
Table of activities to be completed for Internship

S. N	Activity	Suggested Schedule WEEKS
1	Collection of information about industry available and ready for extending training with its offered capacity of students (Sample Format 1)	During 4th semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15)	During 4th semester
3	Communication with Industry and obtaining its confirmation Sample letter Format	14th week of 4th semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	15th week of 4th semester
5	Enrollment of Students for industrial training (Format 3)	During 4th semester
6	Issue of letter to industry for training along with details of students and mentor (Format 4)	15 days before end of 4th semester examination
7	Organize Internship Orientation session for students	During 4th semester examination
8	Progressive Assessment of Internship by industry Supervisor	Each week (16 weeks) -5marks for each week
	Progressive Assessment of Internship by Institute Mentor at the Industry	Each quarter of 1 month (4 weeks) during training period- 5 marks for each quarter
9	Assessment of training by institutional mentor and Industry mentor	5th Semester ESE

Suggestions-

a. Department can take help of alumina or parents of students having contact in different industries for securing placement.
b. Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However, preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
c. Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.

d. The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

H. ROLES AND RESPONSIBILITIES OF STUDENTS:

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives, then the same may be utilized for securing placement for themselves and their peers.
2. Students must fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non- disciplinary action will be taken.
7. Students must maintain a weekly diary (Format 6) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.
8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to their mentor at the institute.
9. Prepare a final report about the training for submitting to the department at the time of presentation and viva- voce and get it signed from a mentor as well as industry training in charge.
10. Students must submit the undertaking as provided in Format 5.

I. TYPOGRAPHICAL GUIDELINES FOR INDUSTRY TRAINING REPORT

1. Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following
2. The training report shall be computer typed (English- British) and printed on A4 size paper.
3. Text Font -Times New Roman (TNR), Size-12 point
4. Subsection heading TNR- 12 point bold normal
5. Section heading TNR- 12 capital bold
6. Chapter Name/ Topic Name – TNR- 14 Capital
7. All text should be justified. (Settings in the Paragraph)
8. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
9. The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.
10. The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

J. FORMAT OF INDUSTRIAL TRAINING REPORT

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- Title Page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1	Organization structure of Industry and general layout.
Chapter 2	Introduction to Industry / Organization (history, type of products and services, turnover and number of employees etc.)
Chapter 3	Types of Major Equipment/raw materials/instruments/machines/ hardware/software used in industry with their specifications, approximate cost, specific use and routine maintenance done
Chapter 4	Processes/ Manufacturing techniques and methodologies and material handling procedures
Chapter 5	Testing of Hardware/Software/ Raw materials/ Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 6	Safety procedures followed and safety gears used by industry.
Chapter 7	Details of Practical Experiences in Industry/Organization if any in Production/Assembly/Testing/Maintenance
Chapter 8	Detailed report of the tasks undertaken (during the training).
Chapter 9	Special/challenging experiences encountered during training if any (may include students liking & disliking of workplaces).
Chapter 10	Conclusion
Chapter 11	References / sources of information

K. LEARNING STRATEGIES DURING TRAINING AT INDUSTRY

Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.

L. Table - Distribution of End-Semester-Examination (ESE) marks of Industrial Training

Internal Examiner			External Examiner	Total ESE marks
Marks for Industrial Training Report	Marks for Seminar/Presentation	Marks for Oral/Viva-voce		
25	25	25	25	100

Format-1

(To *be obtained on Company's Letter Head*)

Collecting Information about Industry/Organization available for training along with capacity

1) Name of the industry/organization:
2) Address/communication details with email:
3) Contact person details:
a) Name:
b) Designation:
c) Email
d) Contact number/s:
4) Type:
a) Govt / PSU / Pvt /
b) Large scale / Medium scale / Small scale

5) Products/Services offered by industry:

6) a. Whether willing to offer Industrial training facility during June to August for Diploma in Engineering students: Yes / No.
b) If yes, whether you offer 16 weeks training: Yes/No
c) Possible Industrial Capacity:

Students	Programme name						Total
	Civil	Mechanical	Electrical	Information Technology	Metallurgy	Electronics & Telecommunication	
Male							
Female							
Total							

7) Whether accommodation available for interns Yes / No. If yes capacity:
8) Whether internship is charged or free:
If charged please specify amount per candidate:

Seal and signature of responsible person at Industry:

Format-2

(Obtaining Consent Letter from parents/guardians)

To,
The principal,
Government Polytechnic, Kolhapur

Subject: Consent for Industrial Training.

Respected Sir,
I am fully aware that -

i. My ward studying in fourth semester at your Government Polytechnic, Kolhapur institute has to undergo 16 weeks of Industrial training for partial fulfillment towards completion of Diploma in _
ii. For this fulfillment he/she has been deputed at _____industry, located at

_____

iii. for Industrial training /internship for the period from _____to _____.

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

a. My ward will undergo the training at his/her own cost and risk during training and/or stay.
b. My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
c. My ward is NOT entitled to any leave during the training period.
d. My ward will regularly submit a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward, who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature:

Name:
Address: _____
Phone Number: _____

Format-3

(Students Enrollment for Industrial Training (To *be maintained by Department*)

(Academic Year –)

Sr. No.	Roll No.	Name of Student	Name of Industry	Name of Mentor at Institute

Format-4

(Issue Letter to the Industry/Organization for the training along with details of students and mentors on Institute Letter Head)

To,
The HR Manager,

_____

_____

Subject: Placement for Industrial training of 16 weeks in your organization
Reference: Your consent letter no___
Sir,
With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.
The purpose of this training is to equip the student with some essential skills relevant to the demands of the industry and world of work, as well as to provide exposure to the professional environment and work culture. It is hoped that this training may enhance his/her employability and livelihood opportunities. In view of the above, we kindly request your support in facilitating this Industrial Training for the student. He/she has been adequately oriented and guided on the expectations of this training, including the maintenance of a daily diary during the training period.
Additionally, the institute has secured the necessary consent and undertaking from the parent/guardian regarding the guidelines for exit training. In view of all the above industry shall refrain from involving students into the mundane and housekeeping activities. Your cooperation in this regard will be highly appreciated.
Diploma programme in _____

Sr. No.	Roll No.	Name of Student	Name and designation of Mentor

Kindly extend all possible cooperation to the students for above.
Thanking you.

Yours Sincerely,

CC- Mentor

Principal
Government Polytechnic, Kolhapur

Format-5

(Undertaking by the students)

To
The principal,
Government Polytechnic, Kolhapur

Subject: Undertaking regarding Placement for Industrial training of 16 weeks duration

I _____Roll No: _____ Son / Daughter of ___
studying in_____department at your Institute, am fully aware of the Industrial Training requirement and related responsibilities and participation in the_____Industrial training from:_____To_____. I assure you that I will be of good behavior and be obedient to the staff and mentor during the Industrial training. I will also abide and will not participate in all activity. I will also discipline myself within the rules and regulations of the Institution. I am also aware that I am participating in the Industrial Training at my own risk and I will not hold the Institute responsible in any way in any eventuality namely Accident
/Injury/death or whatever mishap and I myself will be solely responsible for my safety.

Place:
Date:

Signature of the student

GOVERNMENT POLYTECHNIC, KOLHAPUR

Evaluation Sheet for Formative Assessment of Internship

Academic Year: Department: Mechanical Engineering

Semester: V Course – Internship Course Code - CCH505 Name of Coordinator:

Enrollment No	Name of Student	Marks (5 marks each week) by Mentor & Industry Supervisor jointly																Total [80 Marks] [A]	PA Marks by Mentor faculty (20 Marks) [B]	Total [Marks 100] [A]+[B]
		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16			

Name and Designation of Mentor **Name and Designation of Industry Supervisor**

The faculty should visit the industry at least for four times Online /Off line mode and He will give Marks for 4 Times Quarter wise. [Mentor will give marks 4 times (5 marks each time) and total of 20 marks]

EVALUATION BY MENTOR

Sr No.	Roll No	Quarter 1 Marks Out Of 5 By mentor	Quarter 2 Marks Out Of 5 By mentor	Quarter 3 Marks Out Of 5 By mentor	Quarter 4 Marks Out Of 5 By mentor	Total out of (20)

Weekly Diary for Industrial training

Week 1: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Week 2: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 3: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 4: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 5: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 6: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 7: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 8: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 9: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 10: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 11: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 12: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 13: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 14: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 15: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

Weekly Diary for Industrial training

Week 16: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor: _____

Signature of Industrial Supervisor: _____

COURSE ID : ME
COURSE NAME : INDUSTRIAL ORGANISATION AND MANAGEMENT
COURSE CODE : CCH502
COURSE ABBREVIATION : HIOM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05*	2
	Tutorial Learning	00	
	Laboratory Learning	00	
	SLH-Self Learning	01	
	NLH-Notional Learning	06	

*Online classroom learning Curriculum to be covered in 6 weeks

B. ASSESSMENT SCHEME

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
1.5	15*#	35*#	50	20	-	-	-	-	50	20	100

(Total IKS hours for sem: 02hour)

C. ABBREVIATIONS: -

CL-Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# OnLine Examination, @$ Internal Online Examination.
FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as “Detained" in that semester.
2. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
3. Notional Learning hours be reflected in the Time Table.

* Self-learning includes micro project/assignment / other activities.

D. RATIONALE:

Management ability is a higher-grade ability, which every successful engineer must possess. This science has been developed in those days when it was treated as an art in earlier stages. It is impossible for an individual though technically sound to achieve goals of the organizations. Effective implementation of management

policies is a tough task. The Diploma holder should learn these principles of management and various techniques.

E. COURSE OUTCOMES (COs):

CCH502.1 Apply principles of management and carry out various functions of management
CCH502.2 Prepare organization structure for small and medium scale industry.
CCH502.3 Perform duties of stores in-charge and materials manager.
CCH502.4 Practice industrial safety rules, codes, practices and acts.
CCH502.5 Apply various modern management techniques

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 EngineerIng Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in Mfg & service sector	PSO 2 Start entrepreneurial activity
Competency: The aim of this course is to improve management ability of individual through teaching.	3	3	2	2	3	3	3	3	3
CCH502-1	3	2	2	2	2	3	3	2	3
CCH502-2	3	3	2	3	2	3	3	3	2
CCH502-3	3	3	3	3	2	3	3	2	2
CCH502-4	2	3	3	3	2	3	3	3	3
CCH502-5	2	3	3	3	2	3	3	3	3

Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

F. CONTENT:

I) PRACTICAL EXERCISES - Not Applicable

ii) THEORY

SECTION-I			
Sr. No.	**Topics**	**Teaching (Hours)**	**Theory evaluation**
Course Outcome MEH501: - *Apply principles of management and carry out various functions of management*			
1	**PRINCIPLES OF MANAGEMENT** 1.1 Concept of management 1.2 Principles of management 1.3 Objectives of management 1.4 Scope and importance of management 1.5 Levels of management 1.6 Managerial competencies: Communication, Planning and Administration, Team work, Strategic action and General awareness	**03**	**06**
Course Outcome MEH501: - *Apply principles of management and carry out various functions of management*			
2	**Functions of Management** 2.1 Planning: Forms of planning, Strategic levels and Planning, Phases of Planning 2.2 Decision Making: Decision making conditions, Basic types of Decisions 2.3 Organizing: Introduction to Organization design, basic types of Departmentalization, Co-ordination, Authority 2.4 Motivation: Work Motivation, Three approaches to Motivation, 2.5 Leadership: Leadership and Power, Leadership Development 2.6 Communication: The Communication process, Impact of Information Technology, Hurdles to effective communication 2.7 Controlling: Foundations of control, creative Effective control, Primary methods	**05**	**09**
Course Outcome MEH501: - *Apply principles of management and carry out various functions of management*			
3	**HUMAN RESOURCE MANAGEMENT.** 3.1 Definition and concept, 3.2 Aim, Objectives and functions of HR dept. 3.2 Principles of personnel policy, details recorded in policy 3.3 Recruitment and selection of employees 3.4 Training: Objectives, benefits, types and methods 3.5 Workers Participation in Management	**05**	**10**

Course Outcome MEH501.2 *Prepare organization structure for small and medium scale industry.*			
4	**FORMS OF BUSINESS ORGANISATION** 4.1 Types of industrial sectors 4.2 Forms of business organization 4.3 Individual Proprietorship 4.4 Partnership 4.5 Joint stock companies 4.6 Co-operatives, Public sectors, Government undertakings.	**05**	**09**
	SECTION II		
Course Outcome CCH502.3 *Perform duties of stores in-charge, material and finance manager.*			
5	**MATERIALS MANAGEMENT** 5.1 Importance of purchase 5.2 Functions and Objectives 5.3 Duties of purchasing officer 5.4 Methods of purchasing and procedure 5.5 Scope and importance of material management 5.6 Objectives of material management 5.7 Duties of Material manager 5.8 Concept of supply chain management 5.9 Modern trends in material management: MRP, ERP	**04**	**08**
6	**FINANCIAL MANAGEMENT** 6.1 Concept, Scope and Importance 6.2 Functions of financial management 6.3 Types of capital: Fixed, working 6.4 Factors affecting Working capital 6.5 Capitalization: over, under 6.6 Sources of Finance 6.7 Industrial taxation	**05**	**09**
CCH502.4 Practice industrial safety rules, codes, practices and acts.			
7	**INDUSTRIAL ACT & SAFETY** 7.1 Factory Act, Boiler Act, Workmen Compensation Act, ESI Act, pollution Control Act 7.2 Accidents: Economic aspects, direct and indirect cost of accidents Causes, Types, Remedies, Personal Protective Equipments (PPE), Reporting & Investigation of accidents 7.3 Safety management: safety in industry, committees, programs, Safety codes, Safety training, 7.4 Occupational Safety and Health Administration – Promoting, norms and standards Housekeeping: definition, concept, necessity, advantages, procedure	**05**	**10**
CCH502.5 Apply various modern management techniques.			
8	**MODERN MANAGEMENT TECHNIQUES** 8.1 PERT & CPM 8.2 Various terms related with network analysis 8.3 Various Time estimates 8.4 Construction of Network Diagram Computation of Critical Path	**04**	**09**
	Total	**36**	**70**

G. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level- wise)			Course Outcome	Total Marks
		Remember	Understand	Apply		
1	Principles Of Management	02	02	02	CCH502.1	06
2	Functions Of Management	02	02	05	CCH502.1	09
3	Human Resource management	04	04	02	CCH502.1	10
4	Forms Of Business organization	02	03	04	CCH502.2	09
5	Materials Management	02	02	04	CCH502.3	08
6	Financial Management	02	03	04	CCH502.3	09
7	Industrial Act & Safety	02	04	04	CCH502.4	10
8	Modern Management Techniques	02	02	05	CCH502.5	09
TOTAL		**18**	**22**	**30**		**70**

H. INSTRUCTIONAL METHODS

1. Lectures cum Demonstrations
2. Classroom practices

I. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio presentations, Question Bank

J. REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
1	Bangaand Sharma	Industrial Organisation & Management	Khanna Publisher
2	O P Khanna	Industrial Engg. & Management	DhanpatRai & sons New Delhi
3	P.C. Pandey & C. K. Sing	Management Science	DhanpatRai & sons New Delhi
4	Industrial Organisation	P.T. Ghan	Tata McGraw Hill
5	Management Information System	Waman S. Jawadekar	Tata McGraw Hill
6	P.C. Pandey & C. K. Sing	Management Science	DhanpatRai & sons New Delhi

K. LEARNING WEBSITE & SOFTWARE: -

1. https://nptel.ac.in/courses/122/106/122106031/
2. https://nptel.ac.in/courses/110/105/110105154/
3. https://nptel.ac.in/courses/110/101/110101150/
4. https://nptel.ac.in/courses/110/101/110101153/

*****

COURSE ID:
COURSE NAME : ENTREPRENEURSHIP DEVELOPMENT AND START-UPS
COURSE CODE : CCH501
COURSE ABBREVIATION : HESU

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	02	1
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	-	
Self-Learning Hours (SLH)	01	
Notional Learning (NLH)	03	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	-	-	-	-	-	-	-	50	20	50

(Total IKS Hrs for Sem: Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Globalization, liberalization and Privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is an immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast-growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1) Understanding and applying business principles and labor laws.
2) Improved business skills, imagination and planning of enterprise.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

CCH501-1: Identify entrepreneurial attributes
CCH501-2: Identify the business opportunities that suits you
CCH501-3: Use the support systems to zero down to your business idea.
CCH501-4: Develop comprehensive business plans.
CCH501-5: Prepare plans to manage the enterprise effectively.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepre neurial activity
Competency									
CCH501-1	2	2	2	-	-	3	2	-	3
CCH501-2	2	2	2	2	-	3	2	-	3
CCH501-3	2	2	2	2	-	3	2	-	3
CCH501-4	2	2	2	2	-	3	2	-	3
CCH501-5	2	2	2	2	-	3	2	-	3

F. CONTENT:

i) Practical exercises

Not Applicable

ii) THEORY

Sr. No.	Topics / Sub-topics	Lectures (Hours)
1	**Entrepreneurship Development- Concept and Scope** **Indian Knowledge System for entrepreneurship development (IKS)** 1.1 Concepts and Overview of Entrepreneurship. Evolution and Growth of Entrepreneurship in India. Role of Entrepreneurship in Economic Development. Entrepreneurship as a career. 1.2 Traits of successful intrapreneur / entrepreneur: Consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, 1.3 Entrepreneurship: Scope in local and global market. 1.4 Intrapreneur and entrepreneur. 1.5 Types of enterprises and their features: Manufacturing, Service and trading. 1.6 Steps in Setting up of a business	**03**
2	**Entrepreneurial Opportunities and Selection Process:** 2.1 Product / Service selection: Process, core competence, product / service life cycle, new product / service development process, mortality curve, Creativity and innovation in product / Service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, Factors affecting process selection, Location for an industry, Material handling. 2.3 Market study procedures: Questionnaire design, sampling, Market survey, Data analysis 2.4 Getting information from concerned stake holders such as Maharashtra Centre for Entrepreneurship Development (MCED), National Institute for Micro, Small and Medium Enterprises (NI-MSME, Prime Minister Employment Generation Program (PMEGP), Directorate of Industries (DI), Khadi Village Industries Commission (KVIC).	04
3	**Support Systems:** 3.1 Categorization of MSME, Ancillary Industries. 3.2 Support System-Government Agencies: MCED, NI- MSME, PMEGP, DI, KVIC. 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consolation, technology transfer and quality control, marketing and finance 3.4 Breakeven point, return of investment and return on sales.	**03**
4	**BUSINESS PLAN PREPARATION:** 4.1 Sources of Product for Business: Feasibility study. 4.2 Ownership, Capital, Budgeting, Matching Entrepreneur with the project, Feasibility report preparation and evaluation criteria. 4.3 Business plan preparation.	**03**

Sr. No.	Topics / Sub-topics	Lectures (Hours)
5	**Managing Enterprise:** 5.1 Unique Selling proposition (U.S.P.): Identification, Developing a marketing plan. 5.2 Preparing Strategies of handling Business: Policy making, negotiation and bargaining techniques 5.3 Risk management: [planning for calculated risk taking, initiation with low-cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centers: Role and procedure.	03

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

Sr. No.	Assignments	Relevant CO	Approx Hrs. Required
1	Submit a profile summary (about 500 words) of a successful entrepreneur indicating milestone achievement.	1	02*
2	Undertaking SWOC analysis to arrive at your business idea of a product / service.	1	02
3	Survey industries of your stream; grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	2	02
4	Visit a bank/Financial institution to enquire about various funding schemes for small scale enterprise.	2	02*
5	Collect loan application forms of national banks/other financial institutions.	2	02*
6	Compile the information from financial agencies that will help you set up your business enterprise.	3	02*
7	Compile the information from government agencies that will help you set up your business enterprise.	3	02*
8	Prepare Technological feasibility report of a chosen product/service.	3	02*
9	Prepare a set of short term, medium- and long-term goals for starting a chosen small-scale enterprise.	3	02*
10	Prepare marketing strategy for your chosen product/service.	4	02*
11	Compile the information about insurance schemes covering different risk factors.	4	02
12	Find the breakeven point for the business idea chosen by you.	4	02
13	Prepare a business plan for your chosen small-scale enterprise.	5	02
14	Organize funfair for your class and write report of profit/loss.	5	02
15	Visit report of any industry: Brief history, types and details of services/support assistance being given, any other information which is useful to self-employer/entrepreneur.	5	02

*-Suggested assignment for the students.
Complete any 8 assignments mentioned below given by subject teacher.

H. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

- Not Applicable

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Self-learning ability	05
3	Lateral and Creative thinking	05
4	Conversion of Idea into Business plan	10
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Market Survey / Data collection	10
4	Team work	05
	TOTAL	**25**

I. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Class room practices.
3 Use of projector and soft material for demonstration

J. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

K. REFERENCE BOOKS:

Sr. No.	Title of Books	Author	Publication
1	The entrepreneurial Instinct: How Everyone Has the Innate Ability to Start a Successful Small Business.	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich R. D.	McGraw-Hill Education, New Delhi, 2013, ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen S.B.	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad, 2016; ISBN: 978-0078029169

4	Reading Materials of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad
5	Product Design and manufacturing	Chitale A.K.	PHI Learning, New Delhi,2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special Edition for MSBTE	CPSC, Manila	Tata McGraw Hill, New Delhi
8	Entrepreneurship Development Small Business Management	Khanka S. S.	S. Chand and sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S. Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

L. LEARNING WEBSITE & SOFTWARE: -

1. http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2. http://www.mced.nic.in/allproduct.aspx
3. http://www.mced.nic.in/Publications.html
4. http://niesbud.nic.in/docs/1standardized.pdf
5. http://www.entrepreneur.com/lists
6. http://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7. http://www.nabard.org/Tenders.aspx?cid=501andid=24
8. http://www.nabard.org/content 1.aspx?id=8andcatid=8andmid=488
9. http://www.businesstoday.in/markets
10. http://www.startupindia.gov.in/pdffile.php?title=Sartup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11. http://www.ediindia.org/institute.html
12. http://www.ediindia.org/centres.html
13. http://www.ediindia.org/publication.html
14. http://www.entrepreneur.com/article/247574
15. http://www.nstedb.com/index.html
16. http://www.nstedb.com/training/training.html
17. http://wwwtatasocial-in.com/project-exposure
18. http://www.dcmsme.gov.in/schemes/TEQUPDetail.html
19. http://small.sidbi.in%20/thinking-starting-business/big-list-business-ideas-small-business
20. http://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21. http://www.archive.india.gov.in/business/Industry_services/illustrative.php
22. http://www.nsic.co.in/SCHSERV.ASP

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COURSE ID : **ME**
COURSE NAME : **PROJECT**
COURSE CODE : **MEH513**
COURSE ABBREVIATION : **HPRJ**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	1
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH- Notional Learning	04	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN`	
--	-	-	-	-	-	-	50#	20	50	20	100

(Total IKS Hrs. for Sem.: 00 Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

D. i) RATIONALE: -

In practice, the diploma technicians come across problems of varied nature. He/she will have to solve the problems involving drawings, designs, manufacturing, installation, testing and maintenance of machines. In order to cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, this particular subject is introduced. Projects mainly serve this purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

a) Spirit of enquiry and ability to tackle new problems
b) Creativity and innovativeness
c) Planning and decision-making skills
d) Ability to work in a team and to lead a team
e) Ability of self-directed learning which is required for lifelong learning

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Plan and execute innovative solutions independently or collaboratively to the identified problem statement.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH513-1: Identify a problem statement and establish the action plan.

MEH513-2: Select, collect and use required information/knowledge to solve the identified problem.

MEH513-3: Logically choose relevant possible solution(s)

MEH513-4: Implement the planned activity involving data collection, design and analyses, fabrication, assembly, testing etc.

MEH513-5: Prepare a detailed project report

MEH513-6: Communicate effectively and confidently as a member and leader of a team.

F. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	-	-	-	-	-	3	2	1	2
MEH513-1	1	2	-	-	2	3	2	2	3
MEH513-2	-	2	-	-	3	3	2	2	3
MEH513-3	-	2	-	-	2	3	2	1	3
MEH513-4	-	-	3	3	-	3	2	1	2
MEH513-5	-	-	-	3	-	3	2	1	3
MEH513-6	-	-	-	-	-	3	2	1	3

G. CONTENT

Following activities related to the project are required to be dealt with, during this semester.

1. A group of 3-4 students shall be formed for the project.
2. Projects give a platform for the students to showcase an attitude of inquiry to identify the problem statement related to the programme. Students shall Identify the information suggesting the cause of the problem and possible solutions
3. Topic / Problem statement shall be approved by the guide and Head of department.
4. Each project group shall work on the problem identified in the project by consulting the guide or industry.
5. Each project batch shall prepare an action plan of project activities & submit the same to the respective guide.
6. Students will begin to work as per action plan and maintain a dated ‘weekly diary' for the whole semester indicating all the activities conducted by the student every week in the semester to complete the project. This project ‘weekly diary' should be signed by the teacher at regular intervals.
7. Students shall study and assess the feasibility of different solutions and the financial implications. Students may visit the organisation pertaining to the problem statement as part of study
8. Students should collect relevant data from different sources (books/internet/market/ suppliers/experts through surveys/interviews).
9. Mid-term evaluation of project work shall be done by the departmental evaluation committee.
10. At the end of semester, each project batch shall submit the project report and project.

Components of Project Report:

- Title page
- Certification
- Industry sponsored project certificate (if any)
- Acknowledgements
- Abstract
- Table of contents
- List of figures and tables (if any)
- List of symbols and Abbreviations (if any)

Chapters

1. Chapter-1 Introduction (background of the Industry or User based Problem/Task)
2. Chapter Literature Survey (to finalize and define the Problem Statement)
3. Chapter-3 Scope of the project
4. Chapter-4 Methodology
5. Chapter-5 Details of designs, working and processes
6. Chapter-6 Results and Applications
7. Chapter-7 Conclusions And future scope
8. Appendix (if any)
9. References and Bibliography

Project report preparation Format:

1. The project report shall be printed on white A4 bond paper.
2. The text shall have a standard font of Times New Roman of 12 pts. With 1.15 line spacing.
3. The printed sheets shall have the following written area and margins
   Top margin - 15mm, Bottom margin- 15 mm, Right margin- 15 mm, Left margin- 30 mm
4. Each chapter shall begin on a fresh page. Heading of the chapter shall be printed at the centre of the line in 16 pt. in bold and sub-heading shall have 14 pt in bold.
5. Header: Title of the project. Footer: Institute name, page number (on left side)
6. Project report shall be prepared with following nos;
   a. One copy for department
   b. One copy for project guide
   c. One copy each for students in project group
7. Project report shall be prepared with hard bound covers with cover page matter in golden embossing printing on front cover.

H. Self-Learning Activities for Diploma Project Course

During the course of the project, several self-learning activities will be undertaken by students to develop technical knowledge, practical skills, and project management abilities. These activities help enhance student understanding of the project domain and enable independent problem-solving. The key self-learning areas are summarized below: (Minimum 6 to 8 assignments to be given)

1. Identify problems in society that can be solved through project,
2. Market Survey: systematically gathering and analyzing data to understand customer preferences, needs, and market trends related to a specific product or service,
3. Understanding Project Background: Study similar projects, case studies, and past reports to understand the problem and solution approach.
4. Tool and Software Learning: Learn essential software tools such as CAD, CAM, CAE, MATLAB, Python, Arduino IDE and MS Office through online tutorials and practice.
5. Component Study and Selection: Gain knowledge of mechanical, electrical and electronic components by reading datasheets and specifications.
6. Design of proposed work: Practice designing mechanical parts using simulation tools to validate project ideas before physical implementation.
7. Practical Skill Development: Improve hands-on skills such as machining, and 3D printing, testing, soldering, programming, and Assembling Mechanical Systems through repeated practice.
8. Data Analysis and Testing: Learn to collect and analyze project-related data, conduct basic testing, and interpret results for system improvement.
9. Report Writing and Documentation: Understood the structure and format of technical project reports, including proper formatting, flowcharts, and referencing.
10. Presentation and Communication Skills: Practice delivering project presentations and responding to viva questions by studying sample videos and mock sessions.
11. Time and Team Management: Develop task schedules, allocated responsibilities, and monitored project milestones using planning tools like Gantt charts.

I. Assessment Criteria

i) Summative Assessment of Practical:

Summative Assessment for Project work based on oral/seminar examination shall be done as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Creativity, Innovation in Project Identification/ Project Title	05
2	Literature Review/ Project Proposal	05
3	Project Diary / Log book	05
4	Execution of plan / model	10
5	Project Report	10
6	Presentation	10
7	Question and Answer	05
	Total	**50**

Assessment shall be done based on *Proforma.*

J. INSTRUCTIONAL STRATEGIES:

1. Guidance and discussions.
2. Laboratory experiences and laboratory interactive sessions.
3. Industrial survey / visit.
4. Time bound assignments and work.
5. Project Exhibition
6. Mock presentation of project

PROFORMA FOR PROJECT ASSESSMENT

Government Polytechnic Kolhapur

Used for Summative Assessment Practical /Oral Examination by Internal Examiner & External Examiner

FORMAT FOR EXTERNAL EXAMINATION OF PROJECT

SR.NO	Enrollment No.	Marks of Internal Examiner (25)	Marks of External Examiner (25)	Marks Out of (50)
1				
2				
3				
4				
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26				
27				
28				
29				
30				

Sign.of Internal Examiner
Institute Name
Code

Sign of External Examiner
Instirtute Name
Code

Government Polytechnic Kolhapur

Used for Summative Assessment Practical /Oral Examination by Internal Examiner & External Examiner MPECS-2023

FORMAT FOR SLA MARKS OF PROJECT

SR.NO	Enrollment No.	Marks out of 25(Qtr-1)	Marks out of 25(Qtr-2)	Marks out of 25(Qtr-3)	Marks out of 25(Qtr-4)	Total out of 100	Converted Marks as Per L/A scheme
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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21							
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24							
25							
26							
27							
28							
29							
30							
Sign. of Internal Examiner					Sign of Head of Dept.		
Institute Name::					Institute Name		
Code					Code		

*****

COURSE ID : ME
Course Name : POWER ENGINEERING
Course Code : MEH401
Course Abbreviation: HPER

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	8*	3
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	4	
Self-Learning Hours (SLH)	2	
Notional Learning (NLH)	14	

*Online classroom learning Curriculum to be covered in 6 weeks

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
3	30	70	100	40	25	10	25#	10	25	10	175

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

Engines have vital role in human life. Today's fast lifestyle of human is complimented in great proportion by engine started from steam engine. Presently steam engine are dominated by IC engines. IC engines are used for so many applications in practices, which makes our life handicap without them. Therefore, knowledge of various parts, working, testing maintenance etc. of IC engine, its pollution control and studies is becoming necessary. Next generation of IC engine is gas turbine which also has application in air transport and power generation. Hence knowledge of basic cycle and theoretical aspect involved is necessary. Almost every industry, garages etc. requires an air compressor for various applications hence knowledge of air compressor is essential.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Maintain power engineering devices for various industrial / field applications using relevant knowledge & skills related to power engineering.

E. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following COs on completion of course based learning.

MEH401.1 Understand construction, working and function of various parts of I.C engine.

MEH401.2 Compute various parameters concerning I. C. Engine.

MEH401.3 Estimate the performance of I. C. Engines conducting trial.

MEH401.4 Understand construction, working and function of various parts of air compressor.

MEH401.5 Understand construction, working and function of various parts in RAC.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepre neurial activity
Competency	3	3	3	2	2	2	1	3	3
MEH401-1	3	3	-	1	1	-	1	1	1
MEH401-2	2	3	-	1	1	-	1	1	1
MEH401-3	3	2	1	2	2	-	-	2	2
MEH401-4	2	2	1	2	2	1	-	2	2
MEH401-5	2	2	3	3	-	3	2	3	3

F. CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Power engineering lab* in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles	Number of hrs.	Relevant COs
1	Dismantling and assembling of Petrol / Diesel four stroke Engines with necessary tools.	2	CO1
2	Demonstration of various engine systems through charts and videos.	2	CO1
3	Use of exhaust gas analyzer for S.I engine.	2	CO2
4	Use of exhaust gas analyzer for C.I engine.	2	CO2
5	Trial on Petrol engine with Heat Balance sheet	2	CO2
6	Trial on Diesel engine with Heat Balance sheet	2	CO3
7	Diagnosis test on I.C engine using engine control unit.	2	CO3
8	Visit to Diesel/Petrol engine manufacturing plant.	2	CO3
9	Dismantling and assembling of rotary air compressor with necessary tools.	2	CO4
10	Dismantling and assembling of reciprocating air compressor with necessary tools.	2	CO4
11	To conduct a trial on two stage reciprocating air compressors.	2	CO4
12	Visit to gas turbine power plant	2	CO4
13	Trace the flow of refrigerant through various components of the domestic refrigerator.	2	CO5
14	Assemble / Dismantle various components of water cooler.	2	CO5
15	Assemble / Dismantle various components of window air conditioner.	2	CO5
16	Demonstration of split air conditioner.	2	CO5

Note: Minimum 80% of above list of lab experiment are to be performed.

II) THEORY

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEH401.1 *Understand construction, working and function of various parts of I.C engine.*			
1.	**INTERNAL COMBUSTION ENGINE** 1.1 Classification of IC engines 1.2 Various terms of engines: Bore, Stroke, Dead centers, Compression ratio, Piston displacement, Piston speed 1.3 Two stroke & four stroke engines: Construction, Working, Comparison, Valve timing diagram and Turning moment diagram 1.4 Brief description of IC engine combustion stages (SI & CI), Scavenging, Pre-ignition, detonation, supercharging, Turbo charging 1.5 List of fuels, Lubricants, Additives and their advantages 1.6 Location, Functioning and Materials of various parts of engine.	**12**	**18**
Course Outcome MEH401.2 *Compute various parameters concerning I. C. Engine.* ***MEH401.3*** *Estimate the performance of I. C. Engines conducting trial.*			
2.	**IC ENGINE SYSTEM, TESTING AND POLLUTION CONTROL** **IC engine system: Construction and Working of** 2.1 Carburetion system (Principle and simple carburetor) 2.2 Common rail direct fuel injection system (CRDI) controlled by electronic control unit in C. I. engine, Piezoelectric injectors. Multi point fuel injection system (MPFI) 2.3 Ignition system (Battery, Magneto and electronic ignition system) 2.4 Lubrication system (Principles of Lubrication) **Engine Testing:** 2.5 Indicated Power, Brake Power, Mechanical, Thermal, Relative and Volumetric Efficiency, BSFC. (Simple Numerical) , Morse test 2.6 Heat Balance sheet and performance curves (Simple Numerical) **Pollution Control:** 2.7 Pollutants in exhaust gases of SI and CI engines and their Environmental Effects. 2.8 Pollution measurement 2.9 List of Methods of controlling pollutants as per BS6, EGR (Exhaust Gas Recirculation) lay out, SCR (Selective Catalytic Reduction (SCR) system) 2.10 Euro IV, Euro VI Norms and BS-VI norms.	**12**	**16**

	2.11 Use of microprocessor in I.C engine- Engine control unit (ECU): working and diagnosis procedure. Different sensor used in I.C engine.		

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome: MEH401.4 *Understand construction, working and function of various parts of air compressor.* ***MEH401.5*** *Analyze the performance of air compressor.*			
3.	**AIR COMPRESSORS** 3.1 Classification 3.2 Terminology: Pressure ratio, Compressor capacity, Free Air delivered, Swept volume 3.3 Industrial use of compressed air Reciprocating Compressor 3.4 Construction & working of single and two stages reciprocating compressor 3.5 Equation of work done (Simple Numerical) 3.6 Efficiency: Volumetric, Isothermal and Mechanical (Simple Numerical) 3.7 Intercooler, Advantages of multistage compressor Rotary Compressors 3.8 Construction and working of Roots blower, Vane blower, Screw-Types: Oil Flooded, Oil Free, Centrifugal and Axial flow Compressors (No Numerical) 3.9 Methods of Energy saving in Compressors	**12**	**18**
Course Outcome MEH401.5 *Understand construction, working and function of various parts of gas turbine and jet propulsion.*			
4.	**Refrigeration AND Air Conditioning** 4.1 Definition of refrigeration, refrigeration effect, unit of refrigeration, coefficient of performance 4.2 Vapor Compression Refrigeration Systems (VCRS) : Basic components, flow diagram of the vapor compression cycle 4.3 Vapor Absorption Refrigeration System (VARS) : Principle of vapor absorption refrigeration system, basic components, construction and working of simple vapor absorption refrigeration system, comparison of VCRS and VARS. 4.4 Refrigerants: Definition, desirable properties of refrigerant 4.5 Applications: Specification, construction and working of refrigerator, water cooler, ice plant, and cold storage.	**12**	**18**

	4.6 Air conditioning: Definition, factors affecting comfort air conditioning, classification of air conditioning systems, comfort air conditioning and industrial air conditioning. 4.7 Applications: Construction and working of window air conditioner, split air conditioner.		
	Total	**48**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING):

Assignment

1. Prepare a power point presentation on Bharat Stage & Euro emission norms for I.C. Engine.
2. Make charts for performance characteristics of I.C. engine.
3. Make a chart showing the heat balance sheet format to display in a laboratory.
4. Collect specifications of domestic refrigerators of various air conditioners from manufacturer's websites.
5. Collect information on different tests used for I.C. engines.
6. Make a chart showing valve timing diagrams of four stroke petrol and diesel engines.
7. Prepare maintenance schedule of air compressor.
8. Collect information about fuel injection systems used in S.I & C.I engine.
9. Make a chart showing working of jet propulsion and to display in a laboratory.

Micro project:

1. Select the old parts of any C.I engine and mount it on a wooden board with the label and display it in laboratory.
2. Select the old parts of any S.I engine and mount it on a wooden board with the label and display it in laboratory.
3. Select the old parts of any rotary air compressor and mount it on a wooden board with the label and display it in laboratory.
4. Collect constructional and working details of different types of reciprocating and rotary compressors.
5. Prepare and present a seminar on energy saving opportunities in compressed air systems using any suitable source of information.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Internal combustion engine	6	6	6	18	MEH401.1
I / 2	I.C engine system, testing and pollution control	6	8	4	18	MEH401.2
II/ 3	Air compressors	6	8	4	18	MEH401.3
II /4	Refrigeration and Air Conditioning	6	6	4	16	MEH401.4-5
	Total Marks				**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Proper use of instruments	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Proper use of instruments	05
4	Understanding of practical	10
	TOTAL	**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and solids for demonstration
4. Demonstrations in lab.

K. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

L. REFERENCE BOOKS:

Sr. No.	Name of Book	Author	Publication
1.	Mathur M.L. & Sharma R. P.	Internal Combustion Engines.	Dhanpatrai Publications Pvt. Ltd. New Delhi.
2.	R. K. Rajput	Thermal Engineering	Laxmi Publication New Delhi
3.	R. K. Rajput	A text book of internal combustion Engines	Laxmi Publication New Delhi.
4.	Pundir B. P.	I .C. Engines Combustion & Emissions	Narosa Publishing House, New Delhi
5.	V. M. Domkundwar	A Course In Internal Combustion Engines	Dhanpatrai Publications Pvt. Ltd. New Delhi.
6.	Refrigeration and Air Conditioning	C.P Arora	Tata McGraw Hill Education,
7.	Refrigeration and Air Conditioning	Dr. Sadhu Singh	Khanna Book Publication Co (P) Ltd,

M. LEARNING WEBSITE & SOFTWARE: -

1. https://www. Jalopnik.com /how-variable-valve-timing-works-500056093. http://www.araiindia.com/pdf/India_ *Emission Regulation Booklet*.pdf x) http://industrial-ebooks.com/CBT_Software/aircompressor- Training91.php

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COURSE ID : **ME**
COURSE NAME : **INDUSTRIAL HYDRAULICS AND PNEUMATICS**
COURSE CODE : **MEH507**
COURSE ABBREVIATION : **HIHP**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05*	3
	Tutorial Learning	-	
	Laboratory Learning	04	
	SLH-Self Learning	02	
	NLH-Notional Learning	11	

*Online classroom learning Curriculum to be covered in 6 weeks

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Sem.: 04 Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination. (TNR 12 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Hydraulic and pneumatic operated machines and equipment are widely used in various industries due to its versatility and adaptability to automation. Mechanical engineering technologists are required to maintain such systems in different segments of industries. This competency needs the knowledge of construction and working of different components of hydraulic and pneumatic systems. This course will give the students, the basic skills and knowledge to use and maintain different types of hydraulic systems and pneumatic systems

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

- Industrial visit to study automation by means of hydraulic and pneumatic system such as LPG bottling plant, Hydraulic press, Injection Moulding machine

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH507.1-Recognize standard schematic symbols for hydraulic& Pneumatics system
MEH507.2- Identify various components of hydraulic and pneumatic systems
MEH507.3-Describe Operation and applications of hydraulic & Pneumatics components and accessories
MEH507.4-Operate valves and actuators used in hydraulics and pneumatics
MEH507.5- Prepare hydraulic or pneumatic circuit for simple industrial problem

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

Competency and Cos	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life- long learning	PSO1 Work in mfg & service sector	PSO2 Start entrepreneurial activity
Competency	-	3	3	3	3	-	2	3	1
MEH507 -1	3	3	3	1	3	-	2	3	1
MEH507 -2	-	3	3	1	3	-	1	3	2
MEH507-3	-	3	3	1	3	-	1	3	1
MEH507-4	-	3	3	1	3	-	2	3	1
MEH507 -5	-	3	3	1	3	-	2	3	1

F. CONTENT:

i) PRACTICAL EXERCISES

The following practical exercises shall be conducted as Continuous Assessment in Laboratory in practical sessions of batches about 22 students

Sr. No.	Laboratory experience	Skills / Competencies to be developed	Course Outcome
1	ISO symbols for Hydraulic System elements.	Identification of symbols of various Hydraulic System elements.	MEH507-1
2	Study of various Hydraulic System elements.	Know working of Hydraulic System elements.	MEH507-2 MEH506-3
3	Meter In and Meter Out circuit (hydraulic)	Make connections as per circuit diagram and actuate	MEH507- 4 MEH506-5
4	Bleed Off Circuit. (hydraulic)	Make connections as per circuit diagram and actuate	MEH507- 4, MEH507-5
5	Sequencing Circuit (hydraulic)	Make connections as per circuit diagram and actuate	MEH507- 4 MEH507-5
6	ISO symbols for Pneumatic System elements.	Identification of various Pneumatic System elements.	MEH507-1
7	Study of various Pneumatic System elements.	Know working of Pneumatic System elements.	MEH507-3
8	Speed control circuits. (pneumatics)	Make connections as per circuit diagram and actuate	MEH507- 4 MEH507-5
9	Sequencing Circuits. (pneumatics)	Make connections as per circuit diagram and actuate	MEH507- 4 MEH507-5
10	Care and Maintenance of Hydraulic and Pneumatic System elements	Servicing of various Hydraulic and Pneumatic System elements.	MEH507-3

ii) **THEORY:**

SECTION -1

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEH507-1 *Recognize standard schematic symbols for hydraulic& Pneumatics system* ***MEH507.2-****Identify various components of hydraulic and pneumatic systems*			
1.	**INTRODUCTION TO OIL HYDRAULIC SYSTEMS** 1.1 General layout of oil hydraulic system 1.2 ISO Symbols used of hydraulic system 1.3 Practical applications of hydraulic systems 1.4 Merits and limitations of oil hydraulic systems 1.5 Oils for hydraulic systems, their properties. ISO and SAE grades of oil. 1.6 Selection of fluids, effect of temperature and pressure on hydraulic Fluid 1.7 Hazard and safety in Industrial hydraulic systems	**04**	**06**
Course OutcomeMEH507-3*: Operation of hydraulic& Pneumatics components and accessories*			
2.	**PUMPS FOR HYDRAULIC SYSTEMS** 2.1 Pumps: Vane pump, gear pump, Gerotor pump, screw pump, piston pump (Classification, construction, working principle, symbols) 2.2 Selection of pump for power transmission, pump performance.	**04**	**06**
Course Outcome MEH507-3 *Describe operation and applications of hydraulic& Pneumatics components and accessories* ***MEH507.4-*** *Operate valves and actuators used in hydraulics and pneumatics*			
3.	**COMPONENTS OF HYDRAULIC SYSTEM** **A] VALVES** 3.1 Pressure control valves: Pressure relief valve, Pressure reducing valve, Pressure unloading valve, counter balance valve. 3.2 Direction control valves: Poppet valve, spool valve, one-way valves. 3/2, 4/2, 5/3 D.C. valves with pilot, manually & solenoid operated, Sequence valves. 3.3 Flow control valves: Pressure compensated, non-pressure compensated flow control valve. (Classification, construction, working principle and symbols of all components) **B] ACTUATORS** 3.4 Actuator: Construction, working and symbols 3.5 Rotary Actuators: Hydraulic motors 3.6 Linear Actuators: Cylinders- Single acting, Double acting	**11**	**16**

	C] ACCESSORIES 3.7 Accessories: Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Accumulators. (Types, construction, working principle and symbols of all components)		
Course OutcomeMEH507-5*Prepare circuit diagram for simple industrial problem*			
4	**HYDRAULIC CIRCUITS** 4.1 Meter in, Meter out circuits, 4.2 Bleed off circuit 4.3 Sequencing circuit, (time dependent and travel dependent) 4.4 Hydraulic circuits for Milling machine, grinding machine, Shaper machine Motion synchronization circuits.	**04**	**06**
	TOTAL	**23**	**34**

SECTION-II

Sr. No	**Topics/Sub-topic**	**Teaching (Hours)**	**Theory Evaluation Marks**
Course Outcome MEH507-1 *Recognize standard schematic symbols for hydraulic& Pneumatics system* ***MEH507.2-****Identify various components of hydraulic and pneumatic systems*			
5	**INTRODUCTION TO PNEUMATIC SYSTEMS** 5.1 General layout of pneumatic system 5.2 Applications of pneumatic system 5.3 Symbols used in pneumatic system 5.4 Merits and limitations of pneumatic systems	**04**	**06**
Course Outcome MEH507-3 *Operation of hydraulic& Pneumatics components and accessories*			
6	**COMPONENTS OF PNEUMATIC SYSTEM** **A] COMPRESSOR AND CONTROL VALVES** 6.1 Reciprocating & Rotary compressors 6.2 Control Valves: Pressure regulating valves, Flow Control Valves, Direction Control, Dual pressure valve, Shuttle valve, Quick exhaust valve, Time delay valve. **B] ACTUATORS CLASSIFICATION** 6.3 Linear: Cylinders- Types, construction & working principle 6.4 Rotary: Air motors, construction, working principle **C] ACCESSORIES** 6.5 Accessories: Pipes, Hoses, Fittings, FRL unit (Types, construction, working principle and symbols of all components)	**12**	**20**

Course OutcomeMEH507.5- *Prepare circuit diagram for simple industrial problem*			
7	**INDUSTRIAL PNEUMATIC CIRCUITS** 7.1 Speed control circuits, Sequencing circuits, AND, OR circuits, Time & travel dependent controls- Principle, Construction and practical applications,	**06**	**10**
	TOTAL	**22**	**36**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING):

SUGGESTED MICRO PROJECT:

1) The micro project may be industrial application based, internet based, work shop based, laboratory based or field based. The micro project may encompass one or more CO of the course. Maximum no of students in the micro project group should be four.
2) Suggested topics for micro projects
3) Market survey of oils used in hydraulic systems (manufacturers, specifications, trade names, price etc. (field based/ internet based)
4) Market survey of pumps used in hydraulic systems (manufacturers, specifications, trade names, price etc. (field based/ internet based)
5) Market survey compressors used in pneumatic systems (manufacturers, specifications, trade names, price etc. (field based/ internet based)
6) Market survey of valves, actuators, pipes, seals and accessories used in hydraulic and pneumatic systems. (Field based/ internet based)
7) Visit report of service station, industry using hydraulic/ pneumatic systems.
8) (Field based)
9) Visit report of earth moving machinery repairing workshop. (Field based) vii) Prepare charts of hydraulic pneumatic symbols. (Laboratory based) viii) Prepare cut section model of any hydraulic pneumatic component (work shop based)

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1/I	Introduction to oil hydraulic system.	2	2	2	MEH507-1 MEH507-2	**6**
2/I	Pumps for hydraulic system.	2	2	2	MEH507-3	**6**
3/I	Components of Hydraulic System	4	6	6	MEH507-3 MEH507-4	**16**
4/I	Hydraulic circuit	2	0	4	MEH507-5	**6**
5/II	Introduction to pneumatic system	2	4	0	MEH507-3	**6**
6/II	Components of pneumatic system.	6	8	6	MEH507-3	**20**
7/II	Pneumatic circuit	2	4	4	MEH507-5	**10**
	Total	22	24	24		**70**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Proper use of instruments	10
Affective	Discipline and punctuality	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for practical	05
3	Proper use of instruments	05
4	Understanding of practical	10
	TOTAL	**25**

iv) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1. Lectures cum Demonstrations
2. Classroom practices

K. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio video presentations, Internet, Question Bank

L. REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
1.	S. R. Majumadar	Oil Hydraulic Systems	Tata McGraw Hill
2.	S. R. Majumadar	Pneumatic Systems	Tata McGraw Hill
3.	J. J. Pippenger	Industrial Hydraulics	Tata McGraw Hill
4.	ANDREW PARR	Hydraulics & Pneumatics	JAICO

M. LEARNING WEBSITE & SOFTWARE: -

1. https://nptel.ac.in/content/storage2/courses/112106175/Module%201/Lecture%201.pdf
2. https://www.hydraulicspneumatics.com/fluid-powerbasics/article/21884136/engineering- essentials-fundamentals-of-hydraulic-pumps

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SEMESTER 6TH SCHEME AND CURRICULUM

Mechanical Engineering Department

GOVERNMENT POLYTECHNIC KOLHAPUR																									
Learning and Assessment Scheme for Post S.S.C Diploma Courses																									
Programme Name	: Diploma In Mechanical Engineering																								
Programme Code	: ME											**With Effect from Academic Year**	: 2026-27												
Duration Of Programme	: 6 Semester											**Duration**	: 16 WEEKS												
Semester	: Sixth											**Scheme**	: MPECS 2023												
							Learning Scheme							**Assessment Scheme**												
							Actual Contact Hrs./Week								**Theory**				**Based on LL & TL**				**Based on Self Learning**		
																		Practical							
Sr No	**Course Title**	**Abbreviation**	**Course Type**	**level**	**Course Code**	**Total IKS Hrs for Sem.**	**CL**	**TL**	**LL**	**Self Learning (Activity/ Assignment /Micro Project)**	**Notional Learning Hours /Week**	**Credits**	**Paper Duration (hrs.)**	**FA-TH**	**SA-TH**	**Total**		**FA-PR**		**SA-PR**		**SLA**		**Total Marks**	
														Max	**Max**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**		
1	DESIGN OF MACHINE ELEMENTS	HDME	DSC	4	MEH402	-	4	-	2	2	8	4	4	30	70	100	40	25	10	25	10	25	10	175	
2	INDUSTRIAL ROBOTICS AND AUTOMATION	HIRA	DSE	5	MEH503	-	4	-	2	-	6	3	3	30	70	100	40	25	10	25#	10			150	
3	EMERGING TRENDS IN MECHANICAL ENGINEERING	HETM	DSC	5	MEH511	-	3	-	-	1	4	2	1.5	30*#	70*#	100	40	-	-	-	-	25	10	125	
4	3D MODELLING AND ADDITIVE MANUFACTURING	HTMA	SEC	4	MEH414	-	-	-	4	2	6	3	-	-	-	-	-	25	10	50#	20	25	10	100	
3	ELECTIVE-I (MEH504 TO MEH506)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
7	ELECTIVE-II (MEH508 TO MEH510)		DSE	5		-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175	
Total						**0**	**19**		**12**	**9**	**40**	**20**		**150**	**350**	**500**		**125**		**150**		**125**		**900**	

ELECTIVE- I COURSES																								
1	FOUNDRY TECHNOLOGY	HFTN	DSE	5	MEH504	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
2	TOOL ENGINEERING	HTLE	DSE	5	MEH505	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	AUTOMOBILE ENGINEERING	HAEN	DSE	5	MEH506	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

ELECTIVE -II COURSES

1	INDUSTRIAL ENGINEERING AND QUALITY CONTROL	HIEQ	DSC	5	MEH508	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
2	WELDING TECHNOLOGY	HWTN	DSC	5	MEH509	-	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	REFRIGERATION AND AIR CONDITIONING	HRAC	DSC	5	MEH510	-	4	-	2	2	8	4	3.0	30	70	100	40	25	10	25#	10	25	10	175

COURSE ID : ME
COURSE NAME : DESIGN OF MACHINE ELEMENTS
COURSE CODE : MEH402
COURSE ABBREVIATION: HDME

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH- Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN`	
04	30	70	100	40	25	10	25	10	25	10	175

(Total IKS Hrs. for Sem.: 00 Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. I) RATIONALE: -

The design department of industry is one of the major job areas for Diploma Technicians. Fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Materials, Theory of Machines and Computer Aided Design and Drafting is essential. To enable a student to work there he/she should know how to design the simple machine elements. He/she should also be aware of usual design procedures, selection procedures, codes, norms, standards and guidelines for selection of appropriate material. This subject aims at developing analytical and selection abilities in the student to give solutions to simple engineering design problems using standard procedures.

II) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Design and selection of simple machine elements used in the mechanical industry.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH402-1 Select suitable materials for designing machine elements.
MEH402-2 Design joints and levers for various applications.
MEH402-3 Design the power transmission elements like shafts, keys and couplings.
MEH402-4 Select the power screws and fasteners.
MEH402-5 Design springs for various applications.
MEH402-6 Select standard components like rolling contact bearing with their specifications from manufacturer's catalogue.

F. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Work in mfg & service sector	PSO 2 Start entreprenurial activity
Competency:	2	3	3	2	-	-	-	2	1
MEH402-1	2	3	3	-	-	-	-	2	1
MEH402-2	2	3	3	2	-	-	-	2	1
MEH402-3	2	3	3	2	-	1	-	2	1
MEH402-4	2	3	3	2	-	1	-	2	1
MEH402-5	2	3	3	2	-	1	-	2	1
MEH402-6	2	3	3	2	-	1	-	2	1

G. CONTENT:

i) Practical exercises

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Relevant COs
1	Material used as per IS standards in simple machines	CO1
2	Modes of failure in simple machine components	CO1
3	Design and Knuckle Joint / turnbuckle for given load condition	CO2
4	Determination of dimensions of elements of Hand/Foot lever for given load condition	CO2
5	Design C clamp/ offset link for any one application.	CO2
6	Design a transverse and parallel fillet weld subjected to static and dynamic loading	CO2
7	Design Shaft and key used in various machines like Lathe machine, flour mill, drilling machine etc.	CO3
8	Design of Screw Jack (only screw and nut).	CO4
9	Design of screwed joint subjected to concentric or eccentric load	CO4
10	Design the helical spring.	CO5
11	Select a rolling contact bearing from the Manufacturer's catalogue or Design Databook.	CO6

ii) Theory

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **MEH402-1** *Select suitable materials for designing machine elements.*			
1.	**Fundamentals of Design** 1.1 Machine design: Definition, philosophy, general design procedure, general considerations in design of machine elements. 1.2 Types of loads, concept of stresses, bearing pressure, bending and torsion stresses, principal stresses, strain, stress-strain diagram. (Simple Numericals) 1.3 Factor of Safety, conditions for selection of FOS. 1.4 Stress concentration meaning, causes and remedies 1.5 Designation of materials as per IS code, advantages of standardization 1.6 Concept of Fatigue, S-N curve and Endurance limit. 1.7 Maximum principal stress theory and Maximum shear stress theory. 1.8 Modern Design considerations ergonomics and aesthetic considerations in design	**10**	**12**

Course Outcome **MEH402-2** *Design joints and levers for various applications*			
2.	**Design of joints, Levers and offset links** 2.1 Design of Knuckle Joint, Turnbuckle 2.2 Types of Levers: First Type, Second Type & Third Type of Levers & its application 2.3 Design of Levers: Hand/Foot Lever and Bell Crank Lever 2.4 Design C-clamp and offset links 2.5 Design parallel and transverse fillet weld subjected to static and dynamic loading	**10**	**10**
Course Outcome **MEH402-3** *Design the power transmission elements like shafts, keys and couplings.*			
3.	**Design of Shaft, Keys and Couplings** 3.1 Torsion: Concept, assumptions in theory of pure torsion, torsional equation, angle of twist. 3.2 Design of Shafts: Types of shafts, Shaft materials, Standard sizes, Design of solid and hollow shafts based on strength and rigidity criteria. Design of hollow and solid shaft for combined bending and twisting moments and considering the effect of shock and fatigue. 3.3 Design of keys: Types of keys, applications, design of square and rectangular sunk keys, effect of Keyway on strength of shaft 3.4 Types of keys, effect of keyway on the strength of shaft. design of rectangular and square sunk key. 3.5 Coupling: Types of shafts couplings, Design of muff coupling	**10**	**12**

SECTION –II

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **MEH402-*4*** *Select the power screws and fasteners.*			
4.	**Design of Power screws and Fasteners** 4.1 Types of thread profiles used in power transmission and fastening, terminology, relative merits and demerits of each thread profile. 4.2 Torque required to overcome thread and collar friction (no derivation), Efficiency of power screws, Self-locking and overhauling of power screw. 4.3 Stresses induced in screws and nuts (power screw and screwed joint). 4.4 Design of Screw Jack (only screw and nut). 4.5 Design of Bolted joints subjected to direct and eccentric loading, Eccentric load acting parallel to axis of bolt and perpendicular to axis of bolt. (Except angular loads) 4.6 Bolts of Uniform Strength	**12**	**12**

Course Outcome* MEH402-*5 *Choose springs for various applications.*			
5.	**Design of Springs** 5.1 Springs: Classification and Applications of Springs, Spring - terminology, materials specifications. 5.2 Stresses in helical springs, Wahl's stress factor, Deflection of springs. 5.3 Energy stored in springs, Springs in series and parallel 5.4 Design of Helical springs used in I.C. engine valves, weighing balance, railway buffers.	**10**	**12**
Course Outcome MEH402-6 *Select standard components like rolling contact bearing with their specifications from manufacturer's catalogue.*			
6.	**Selection of antifriction bearing and gear** 6.1 Bearings: Concept, classification, terminology, applications. 6.2 Selection of bearing (radial ball bearing only) from manufacturer's catalogue. (No numerical) 6.3 Design of spur gear using Lewis and Buckingham's equation, (Simple Numerical), selection of gears from standard sizes.	**08**	**12**
Total		**60**	**70**
Summative assessment – The theory paper should be such that the total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

H. LIST OF ASSIGNMENTS UNDER SLA

A suggestive list of Self Learning Assessment is given here. Similar Self Learning Assessment could be added by the concerned faculty:

1. find load, stresses on a single point cutting tool and also prepare a chart/model for the same.
2. Make models of various joints and levers highlight resisting sections of different elements. (use wood or M.S material)
3. Prepare a list of different types of bearings used in a bike and write their specifications and basis for selection.
4. Prepare list of different types of levers and springs used in a bike, bicycle, Auto Rickshaw, Moped and write their specifications and basis for selection
5. Make a chart indicating different thread profile and sizes required for different loads in case of screw jack, toggle jack, C-clamps and lead screw of machines.
6. Collect different types of springs and write applications of the same.

I. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Fundamentals of Design	4	4	4	12	MEH402-1
I / 2	Design of joints, Levers and offset links	2	4	4	10	MEH402-2
I / 3	Design of Shaft, Keys and Couplings	4	4	4	12	MEH402-3
II /4	Design of Power screws and Fasteners	4	4	4	12	MEH402-4
II /5	Design of Springs	2	6	4	12	MEH402-5
II / 6	Selection of antifriction bearing and gear	2	6	4	12	MEH402-6
	Total Marks				**70**	

J. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical submission shall be assessed for 25 marks as per following criteria:

Sr. No.	Particulars	Marks out of 25
01	Understanding and application	10
02	Design calculations.	10
03	Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Sr. No.	Particulars	Marks out of 25
01	Understanding and application	10
02	Design calculations.	10
03	Answer to sample questions	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

K. INSTRUCTIONAL METHODS

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and models for demonstration

L. TEACHING AND LEARNING RESOURCES

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

M. REFERENCE BOOKS

Sr.No.	Author	Name of Book	Publication
1	Bhandari V. B.	Design of Machine Elements	McGraw-hill education India Pvt. limited, New Delhi, 2017, ISBN-13:978-9339221126
2	Khurmi R. S. and Gupta J. K.	Machine Design	S. Chand New Delhi, 2005, ISBN 10:8121925371 ISBN13:9788121925372
3	Jindal U. C.	Machine Design	Pearson Education India New Delhi, 2010, ISBN13: 9788131716595
4	Pandya and Shah	Machine Design	Charotar Publishing house Pvt. Ltd. Anand, Gujarat, 2015, ISBN-13:9789385039102
5	Shigley	Mechanical Engineering Design	McGraw-hill education India Pvt. limited, New Delhi, 2017, ISBN-13:978-9339221638
6	PSG	Design Data Book	PSG College of Technology Coimbatore, 2012, ISBN-10: 8192735508
7	ISO IS Codes: IS 4218: 1967 ISO Metric Threads IS 2693: 1964 Cast Iron Flexible Couplings IS 2292: 1963 Taper keys and Keyways IS 2293: 1963 Gib Head Keys and Keyways IS 2389: 1963 Bolts. Screws, Nuts and Lock Nuts IS 4694: 1968 Square threads IS 808: 1967 Structural Steel		BIS New Delhi
8	SKF/NBC	SKF/NBC Catalogue for Bearings	Catalogue for Bearings

N. LEARNING WEBSITE & SOFTWARE

1. http://nptel.ac.in/courses/112105124/
2. https://www.youtube.com/watch?v=CLeLFUrvO2g
3. www.machinedesignonline.com
4. www.engineeringtoolbox.com
5. https://www.youtube.com/watch?v=N5SckoiTDxA
6. https://www.youtube.com/watch?v=GfbcxJmjn9s

7. http://www.ignou.ac.in/upload/Unit-5-60
8. https://sizes.com/numbers/preferred_numbers.htm
9. www.robot-and-machines-design.com/en/articles/mech
10. http://www.youtube.com/flangedcoupling
11. http://www.youtube.com/screwjack

*****

COURSE ID : ME
COURSE NAME : INDUSTRIAL ROBOTICS AND AUTOMATION
COURSE CODE : MEH503
COURSE ABBREVIATION : HIRA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	3
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	00	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN`	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
3	30	70	100	40	25	10	25#	10	-	-	150

C. ABBREVIATIONS:

CL-classroom learning, TL-tutorial learning, LL-laboratory learning, SLH-self learning hours, NLH -Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self learning assessment

Legends: @internal assessment, #external assessment, *#online Examination, @$Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks inf a prof any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in sla of any course, then the candidate shall be declared as fail and will have to repeat and resubmit sla work.
4. Notional learning hours for the semester are (CL+LL+TL+SL) hrs.*15Weeks
5. 1(one)credit is equivalent to 30 notional hrs.
6. *Self learning hours shall not be reflected in the timetable.

*Self learning includes microproject/assignment/other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Industrial robots are widely used in many manufacturing industries, to make it more competitive and efficient. The most obvious impact of industrial robots is that they eliminate many dull, dirty, dear, difficult and dangerous tasks. The use of robot helpful in hazardous and challenging environments. The purpose of Industrial Robotics course is to respond the demands of workforce in industry. It is enormous need that students to learn Industrial Robotics to become industry ready.

ii) INDUSTRY/EMPLOYER EXPECTED OUTCOME: -

Operate industrial robot by developing program and using various sensors.

E. COURSE LEVEL LEARNINGOUTCOMESCOS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

MEH503.1 – Understanding industrial robot and safety.

MEH503.2 – Identify basic components of industrial robot.

MEH503.3 – Select Industrial robot for given applications.

MEH503.4 – Select actuator and sensor for given robotic application.

MEH503.5 – Operate & maintain industrial robot.

MEH503.6 – Operate & Program robot for given application.

F. COURSE OUTCOMES AND PROGRAMME OUTCOMES / PROGRAMME SPECIFIC OUTCOMES (CP-CO-PO/PSO) MATRIX

[Note: Correlation levels:1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Lifelong learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
MEH503-1	3	3	2	1	-	1	1	-	-
MEH503-2	3	3	2	1	-	1	1	-	-
MEH503-3	3	3	2	1	-	1	1	-	-
MEH503-4	3	3	2	1	-	1	1	-	-
MEH503-5	3	1	-	-	2	1	1	-	-
MEH503-6	3	1	-	1	-	1	1	-	-

G. CONTENT:

i) Practical Exercises:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No.	Laboratory experiment	Course outcomes
1	Introduction to Industrial robotics lab and safety	**MEH503-1**
2	Robot installation and control panel wiring	**MEH503-5**
3	Demonstration operation of teach pendant	**MEH503-2**
4	Operate robot for basic motions using teach pendant	**MEH503-5**
5	Operation of Motor and drive	**MEH503-2**
6	Demonstration of pneumatic system	**MEH503-2**
7	Interfacing of end effectors	**MEH503-2**
8	Interfacing of sensors.	**MEH503-4**
9	Introduction to microcontrollers and PLC	**MEH503-6**
10	Robot programming basic- Basic Robot Program Instructions: MOVE, POINT, WAIT, SET, IF, ELSE, LOOP, HALT, JUMP	**MEH503-5**
11	Industrial robot program for Merged Movements, Circular and Arc Movements	**MEH503-5**
12	Setup, operating, Hands on Training and Programming for Robotic MIG Welding	**MEH503-6**
13	Setup, operating, Hands on Training and Programming for 2D Path Following	**MEH503-5,6**
14	Setup, operating, Hands on Training and Programming for Color Sensing	**MEH503-5,6**
15	Setup, operating, Hands on Training and Programming for Magnetic Pick and Place	**MEH503-5,6**
16	Setup, operating, Hands on Training and Programming for Gluing Application	**MEH503-5,6**

ii) Theory

SECTION I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEH503.1 Understanding industrial robot and safety.			
1.	**Introduction to Industrial Robotics & Safety** 1.1 Introduction, Definition, need, brief history of Industrial Robots 1.2 Automation: Type of automation, Need for Automation 1.3 Application of Robots in Industries 1.4 Types of Robots 1.5 Laws of Robot. 1.6 Safe Practices while operating the Robot, Safety Symbols, Safety Gear, Applicable Safety Standards, General Safety Information, Safety Symbols on the Robotic Arm, Robot Controller, and Teach Pendant. 1.7 Risk Assessment, Workspace, and Safety Zones, Personal Safety Equipment, Moving the Robot without Power, Residual Risks.	**10**	**10**
MEH503.2 Identify basic components of industrial robot.			
2.	**Components & Anatomy of Industrial Robot** 2.1 Robot configurations- Polar (Spherical), Cylindrical, Cartesian Coordinate, Jointed arm (Articuted), SCARA (Selective Compliance Assembly Robot Arm). 2.2 Basic elements of Robot system (Robot Anatomy): - Base, Manipulator arm, End Effectors, Sensors and transducers, Actuators and Drives, Control systems 2.3 Robot specification: - Degree of Freedom, Work envelope, Load carrying capacity, Speed of movement, Accuracy, Repeatability, Control Resolution, Spatial resolution, 2.4 Basic Robot motions: - Vertical motions, Radial motions, Rotational motions, Pitch motions, Roll motions, Yaw motions. 2.5 Types mechanical joints used in Robotics system: - Linear Joint, Orthogonal joint, Rotational Joint, Twisting Joint, Revolving Joint (Symbol, Notations) 2.6 Robots End Effectors: Types of End Effectors - Gripper and Tools, Grippers Mechanical, Pneumatic, Magnetic, Vacuum, adhesive, Considerations in gripper selection	**12**	**14**
MEH503.3 Select Industrial robot for given applications.			
3.	**Industrial Robot Selection** 3.1 Why to use a Robot? 3.2 Selection and Classification of Industrial Robots. 3.3 Defining Parameters of Robots. 3.4 World Statistics of Industrial Robotics 3.5 Robots in Industry 3.6 Major Robot Manufacturers	**08**	**10**
	Total	**30**	**34**

SECTION II			
Sr. No	**Topics**	**Lectures (Hours)**	**Theory evaluation Marks**
MEH503.4 Select actuator and sensor for given robotic application.			
4.	**INDUSTRIAL ROBOT: ACTUATORS, DRIVES & SENSORS** 4.1 Actuators and types: Pneumatic, Hydraulic and Electric, 4.2 Need of Pneumatic System, Basic Components of Pneumatic System, Compressor, Valves, Actuators 4.3 Different Electric Rotary Actuators, Recent Advances in Actuators 4.4 Drive and drive system: Pneumatic, Hydraulic and Electric, Drive Systems. 4.5 Robotic Sensors: Introduction to Sensors in robotics, classification of Sensors – Tactile Sensors, Touch sensors, Force sensors, Force sensing wrist, Joint sensing, Tactile array sensors, Proximity and Range Sensors, Miscellaneous Sensors and Sensor based Systems, Uses of Sensors in Robotics. 4.6 Encoders: Incremental and Absolute Encoders. 4.7 Desirable features of sensors in Robotics.	14	16
MEH503.5 Operate & maintain industrial robot.			
5	**INDUSTRIAL ROBOT: INSTALLATION, OPERATION, PROGRAMMING & MAINTENANCE** 5.1 Industrial Robot Installation: Lifting and Mounting of Robotic Arm and Controller. 5.2 Connecting Power Cables, Encoder Cables, and Teach Pendant 5.3 Robot Operation, Switching Modes, Jogging, Homing the Robot 5.4 Managing Robot Errors and Faults, logging in and Configuring I/O 5.5 Robot Programming & Operating: Brief Introduction to Teach Pendant, Robot Programming Instructions, Jogging of Robot, Overview of Teach Pendant, Robot Arm, and Robot Controller, Central Processing Unit (CPU), I/O Channels, CANI/O Module, Removable Storage, Basic Robot Program Instructions: MOVE, POINT, WAIT, SET, IF, ELSE, LOOP, HALT, JUMP, 5.6 Maintenance of Industrial Robot: Inspection of Belts and Pulleys, Changing Belts, Parameters Measurement (Voltage/Current), Recommended Spares, Troubleshooting, Fault List.	10	12
MEH503.6 Operate & Program robot for given application.			
6	**APPLICATION OF PLC & MICROCONTROLLER IN INDUSTRIAL ROBOT** 6.1 Robots in material handling- Pick and Place, Palletization. 6.2 Robots in processing operations – Spotwelding, Continuous arc welding, Spray coating, 6.3 Robots in automated assemblies &inspections. 6.4 Basics and Configuration of Arduino. 6.5 Basics of Microprocessors 6.6 Configuration and Use of Raspberry Pi	06	08
	Total	30	36

Semester end exam question paper should be such that total marks of questions on each topic are one and half times the marks allotted above. Candidate can attempt questions for the above allotted marks.

LIST OF ASSIGNMENTS UNDER SLA: Not Applicable

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks			Total marks
		Knowledge	Comprehension	Application	
I/1	Introduction to Industrial Robotics & Safety	02	04	04	**10**
I/2	Components & Anatomy of Industrial Robot	04	04	06	**14**
I/3	Industrial Robot Selection	02	04	04	**10**
II/4	Industrial Robot: Actuators, Drives & Sensors	04	08	04	**16**
II/5	Industrial Robot: Installation, operation, Programming & Maintenance	04	04	04	**12**
II/6	Application of PLC & Microcontroller in Industrial Robot	02	02	04	**08**
TOTAL		**18**	**26**	**26**	**70**

I. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical submission shall be assessed for 25 marks as per following criteria:

Sr. No.	Particulars	Marks out of 25
1	Understanding and application	10
2	Observation table and recording	05
3	Interpretation of result and conclusion	05
4	Discipline and punctuality	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Term-end OR/PR Examination (External) shall be conducted as per the following criteria

Sr. No.	Criteria	Marks allotted
1	Understanding and application	10
2	Observation table and recording	5
3	Interpretation of result and conclusion	5
4	Answer to sample questions	5
Total		**25**

K. INSTRUCTIONAL METHODS:

i) Lectures and discussions.
ii) Laboratory experiences and laboratory interactive sessions.
iii) Time bound assignments.

L. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

M. REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
1.	R.K. Rajput	Robotics And Industrial Automation	S. Chand Limited New Delhi 2022
2.	Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger Nagel, Ashish Dutta	Industrial Robotics - Technology, Programming and Applications	McGraw Hill Education
3.	R Mittle, I Nagrath	Robotics and Control	McGraw Hill Education
4.	S. R. Deb, Sankha Deb	Robotics Technology and Flexible Automation	McGraw Hill Education

N. Learning Website

1. https://ifr.org/
2. https://www.exeter.ac.uk/
3. https://www.gre.ac.uk/
4. https://nptel.ac.in/courses/112105319
5. https://nptel.ac.in/courses/112105249
6. https://www.youtube.com/watch?v=zr7_XgJWMfQ
7. http://www.roboanalyzer.com/tutorials.html
8. https://www.youtube.com/watch?v=l1gRr_NI4BU
9. https://www.youtube.com/watch?v=27eqkjOh-j0
10. https://www.youtube.com/watch?v=X7iBT5l599c
11. https://www.youtube.com/watch?v=_canCYWZPsc&t =227s
12. http://vlabs.iitkgp.ernet.in/mr/exp0/index.html#

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COURSE ID:
COURSE NAME : EMERGING TRENDS IN MECHANICAL ENGINEERING
COURSE CODE : MEH511
COURSE ABBREVIATION: HETM

A. LEARNING SCHEME:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	03	2
Tutorial Learning (TL)	00	
Laboratory Learning (LL)	00	
Self-Learning Hours (SLH)	01	
Notional Learning (NLH)	04	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
	Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1.5	30*#	70*#	100	40	-	-	-	-	25	10	125

(Total IKS Hrs for Sem: 00 Hrs)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, ***# On Line Examination**, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONALE:

As new technologies rapidly transform the manufacturing industry and related sectors, this course on Emerging Trends in Mechanical Engineering is designed to equip diploma pass outs with the latest knowledge essential for their professional growth. The course covers key areas such as green fuels, autonomous and sustainable maintenance practices, data analytics in manufacturing, and the integration of autonomous vehicles. It also explores the use of drones and autonomous technologies in agriculture. By focusing on these current trends, the course aims to enhance the skills of Mechanical, Automobile, Production, and Mechatronics diploma engineers, preparing them to excel in a rapidly evolving technological environment.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1) Adopt recent trends in mechanical engineering across various mechanical and allied industries.
2) Learn and adopt various new maintenance techniques

E. COURSE LEVEL LEARNING OUTCOMES (CO'S) (TNR 14)

MEH511-1 - Select appropriate green fuels for various applications for considering environmental sustainability.
MEH511-2 - Apply the principles of Autonomous and Sustainable maintenance practices in industry to improve equipment reliability and efficiency.
MEH511-3 - Identify the levels of autonomy in various mobility systems.
MEH511-4 - Use data analytics techniques to improve manufacturing processes and systems.
MEH511-5- Utilize automated equipment and technologies for various agricultural applications.

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/ development of solutions	PO 4 Engineering tools, experimentation & testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 project manage-ment	PO 7 Life-long learning	PSO 1 Work in Mfg & service sector	Ps 2 Start entrepre neurial activity
Competency									
MEH511-1	3	-	-	-	2	-	3	-	-
MEH511-2	3	-	-	-	2	-	3	-	-
MEH511-3	3	-	-	-	2	-	3	-	-
MEH511-4	3	-	-	-	2	-	3	-	-
MEH511-5	3	-	-	-	3	-	3	-	-

F. CONTENT:

i) Practical exercises: NOT APPLICABLE

ii) THEORY

SECTION – I

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
Course Outcome MEH511-1 *Select appropriate green fuels for various applications for considering environmental sustainability.*			
1.	**Green Fuels** 1.1 Green Fuels: Introduction, Characteristics, Benefits and advantages. 1.2 Classes of Green Fuels: 1st Generation, 2nd Generation, 3rd Generation and 4th Generation Green Fuels 1.3 Types and Applications of Green Fuels: Biofuel, Hydrogen fuel, Synthetic fuel, Algae fuel, Bio-diesel from plants, Applications of Green Fuels in Automobile, Power and Heat, Aerospace sectors.	**08**	**10**
Course Outcome MEH511-2 *Apply the principles of Autonomous and Sustainable maintenance practices in industry to improve equipment reliability and efficiency.*			
2.	**Recent trends in Manufacturing systems** 2.1 Big Data in Manufacturing: Introduction, Big Data Characteristics, Benefits 2.2 Data Analytics in manufacturing: Introduction, Steps in Data Analytics, Types of Data Analytics, Data Analytics techniques, Applications of Big Data analytics in Manufacturing – Preventive maintenance, Product Design, Production Management Automation, Customer Experience, Supply Chain Improvement, Benefits.	**08**	**12**
Course Outcome MEH511-2 *Identify the levels of autonomy in various mobility systems.*			
3.	**Autonomous Vehicles** 3.1 Autonomy in Mobility Systems (Autonomous Vehicle): Levels, Components, Benefits. 3.2 Systems used in Autonomous Vehicles: Advanced Driver Assistance Systems (ADAS) and Full Self-Driving (FSD) 3.3 Applications of Autonomy in other Mobility Systems: Autonomous Trains, Autonomous Ships, Autonomous Aircrafts (Unmanned Aircraft Systems (UAS)	**7**	**12**

SECTION – II

Sr. No	Topics/ Subtopics	Learning (Hours)	Classroom learning evaluation Marks
***Course Outcome* MEH511-4** - *Use data analytics techniques to improve manufacturing processes and systems.*			
4.	**Recent Trends in Maintenance** 4.1 Autonomous Maintenance: Concept, Pillars of TPM, Implementation steps, benefits. 4.2 Sustainable Maintenance: Concept, Importance, Implementation steps, benefits. 4.3 Data Analytics in Quality Control: Introduction, Applications, Benefits. 4.4 Data Analytics in Predictive Maintenance: Introduction, concept of Computerized Maintenance Management System (CMMS).	**10**	**16**
***Course Outcome* MEH511-5** *Utilize automated equipment and technologies for various agricultural applications.*			
5.	**Recent Trends in Agriculture Engineering** 5.1 Automation in Agriculture: Introduction, Automated Farm Equipments - Agri-robots, Harvesting robots, Inspection and Monitoring Agriculture robots, Automatic Seeding and Planting Machine, AI Operated Irrigation Systems, Benefits 5.2 Autonomous Tractor: Self Driving Tractors, Features and Advantages 5.3 Agricultural Drones: Soil and Field Analysis, Crop Monitoring, Plantation, Crop Spraying, Advantages of Drones, Government Schemes for Drone Usage. 5.4 Smart greenhouses: Concept, components, Differentiate Smart greenhouses with traditional greenhouses, benefits	**12**	**20**
Total		**45**	**70**
Summative assessment – Theory paper should be such that total marks of questions on each topic are one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

***Complete all assignments mentioned below or any one microproject or activity given by subject teacher.**

Suggested Activity for Students

Write a report with the help of the internet or do a market survey on the topics such as,

1. Green Hydrogen Production and the Emerging Hydrogen Economy
2. Advanced Biofuels and it's Production from Waste Materials
3. Sustainable Aviation Fuels (SAF) and Decarbonization of Air Transport
4. Carbon Capture, Utilization, and Storage (CCUS) Technologies
5. Fuel Cell Technology for Transportation and Power Generation

6. Energy Storage Solutions: Advancements in Battery Technology
7. Renewable Methanol and Ammonia as Marine Fuels
8. Policies of government of India Regulations, and the Economics of Green Fuels
9. Introduction to Industry 4.0 and Smart Manufacturing
10. Internet of Things (IoT) in Manufacturing (Industrial Internet of Things or IIoT)
11. Additive Manufacturing (3D Printing) technology
12. Green Manufacturing and Sustainable Practices
13. Augmented Reality (AR) and Virtual Reality (VR) in maintenance, assembly, and training
14. Levels of Autonomous Driving Vehicle Connectivity V2X
16. Simulation and Testing of autonomous vehicles
17. Integration of IoT and Big Data related to autonomous vehicles
18. Industrial Internet of Things (IIoT) in Maintenance
19. Digital Twin Technology
20. Internet of Things (IoT) Applications in Agriculture (e.g., soil moisture, temperature sensors)
21. Precision Agriculture and Smart Farming Technologies
22. Use of Drones (UAVs) for Crop Monitoring and Field Analysis
23. Water Conservation and Smart Irrigation Systems (drip, sprinkler, and automated systems)
24. Big Data Analytics for Informed Farm Management Decisions

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I/1	Green Fuels	4	2	4	**10**	CO1
I/2	Recent trends in Manufacturing systems	6	2	4	**12**	CO2
I/3	Autonomous Vehicles	4	4	4	**12**	CO3
II/4	Recent Trends in Maintenance	4	4	8	**16**	CO4
II/5	Recent Trends in Agriculture Engineering	4	8	8	**20**	CO5
TOTAL		**22**	**20**	**28**	**70**	

I. ASSESSMENT CRITERIA:

i) Formative Assessment of Practical: - NOT APPLICABLE

ii) Summative Assessment of Practical: NOT APPLICABLE

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

1 Lectures cum Demonstrations,
2 Classroom practices.
3 Use of projector and soft material for demonstration

K. TEACHING AND LEARNING RESOURCES:

Chalk board, PowerPoint presentations and Demonstrative kits, Videos.

L. REFERENCE BOOKS:

Sr. No	Author	Title	Publisher with ISBN Number
1	Carlos Ricardo Soccol, Satinder Kaur Brar, Craig Faulds, Luiz Pereira Ramos	Green Fuels Technology: Biofuels (Green Energy and Technology)	Springer International Publishing AG; 1st ed. 2016edition(19August2016);01149 344934,ISBN-13:978-3319302034
2	Fumio Gotoh	Autonomous Maintenance in Seven Steps: Implementing TPM on the Shop Floor	1st Edition, Productivity Press, ISBN-13: 978- 0367199869
3	Samuel Theodore, Daniel Lucky	Autonomous Maintenance	MaintenancePro,2023, ISBN-13:979-886417453
4	Matthias Hartwig	Self-driving cars	E-book,2020, by BMW
5	George Dimitrakopoulos, Aggelos Tsakanikas, Elias Panagiotopoulos	Autonomous Vehicles Technologies, Regulations, and Societal Impacts	Elsevier,2021, ISBN-13:978-0323901376
6	Yan Li, Hualiang Shi	Advanced Driver Assistance Systems and Autonomous Vehicles	Springer, Singapore,2022, ISBN-13: 978- 9811950520
7	P Suresh, T. Poongodi, B Balamurugan, Meenakshi Sharma	Big Data Analytics in Smart Manufacturing: Principles and Practices	December 14, 2022 by Chapman & Hall, ISBN- 13: 978-1032065519
8	Rania I.M. Almoselhy Rania I.M. Almoselhy, Ravindran Chandran, Abisha Juliet Mary S J	Current Trends in Agriculture & Allied Sciences (Volume-1)	S. P. Publishing, Bhubaneshwar, Odisa,2023, ISBN-13: 978-9359061382
9	Dr. Suman Lata, Mamta J. Patange, Dr. Anand K. Gore, Suchibrata Chamuah and Dr. Chandana Behera	Recent Trends in Agriculture (Volume-5)	Integrated Publications, New Delhi,2023, ISBN- 13: 978-9395118644

M. LEARNING WEBSITE & SOFTWARE: -

1 https://www.engieimpact.com/insights/green-fuels
2 https://www.youtube.com/watch?v=T_S7Q3Uede4
3 https://www.researchgate.net/publication/359732622_Green_fuels_concepts_benefits_and_studies_in_Nigeria/link/624c10bec7ab230e99cef13a/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19
4 https://nitsri.ac.in/Department/Chemical%20Engineering/BRTL12.pdf
5 https://www.youtube.com/watch?v=4-R5Sh-xSiI&t=5s
6 https://www.youtube.com/watch?v=ZJ6tr1kkRDg
7 https://www.youtube.com/watch?v=HgF7E5q9sU4&t=1s
8 https://www.youtube.com/watch?v=gEy91PGGLR0
9 https://www.youtube.com/watch?v=ACxTcsxSYvE
10 https://www.youtube.com/watch?v=31W0EzcfE74
11 https://www.youtube.com/watch?v=P2YPG8PO9JU
12 https://www.youtube.com/watch?v=8-uPCmHX3U0
13 https://www.youtube.com/watch?v=JeU_EYFH1Jk
14 https://www.youtube.com/watch?v=tSdIgGin_rk
15 https://www.skillindiadigital.gov.in/courses/detail/32d86c56-efc6-4c33-9c65-17901e296f8e
16 https://www.youtube.com/watch?v=q7tFDw5SAAU
17 https://www.youtube.com/watch?v=_Dmb1GN52no

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COURSE ID : ME
COURSE NAME : 3D MODELLING AND ADDITIVE MANUFACTURING
COURSE CODE : MEH414
COURSE ABBREVIATION: HTMA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	00	3
	Tutorial Learning	00	
	Laboratory Learning	04	
	SLH-Self Learning	02	
	NLH-Notional Learning	06	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN`	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
04	-	-	-	-	25	10	50#	20	25	10	100

(Total IKS Hrs. for Sem.: 04 Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.(TNR 12 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Mechanical, Plastic, Automobile and allied Industries need to build model-based applications which are being developed using "solid modeling software". This course deals with concepts of solid modeling to enhance solid modeling skills of diploma students. This course will enable the students to inculcate solid modeling and additive manufacturing concepts and methodology to solve engineering problems.

E. 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:

MEH414.1 Prepare 2D Drawing using sketcher workbench of any parametric CAD software.

MEH414.2 Generate 3D Solid models from 2D sketch using Part workbench of any parametric CAD software.

MEH414.3 Prepare assembly of part models using Assembly workbench of any parametric CAD software.

MEH414.4 Generate orthographic views of 3D solid models/assemblies using drafting workbench of any parametric CAD software.

MEH414.5 Plot a drawing for given part model/assembly.

MEH414.6 Print components using 3D Printer/Rapid prototyping machine.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design / Development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering Practices for society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 Work in mfg & service sector**	**PSO 2 Start entrepreneurial activity**
Competency: Use drawing instruments to draw different curves and projections.	3	-	-	1	1	-	-	-	-
Prepare 2D Drawing using sketcher workbench of any parametric CAD software.	3	-	-	-	-	-	-	-	-
Generate 3D Solid models from 2D sketch using Part workbench of any parametric CAD software	3	-	1	-	-	-	-	-	-

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design / Development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering Practices for society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 Work in mfg & service sector**	**PSO 2 Start entrepreneurial activity**
Prepare assembly of part models using Assembly workbench of any parametric CAD software	3	-	-	1	1	-	-	-	-
Generate orthographic views of 3D solid models/assemblies using drafting workbench of any parametric CAD software.	3	-	1	-	-	-	-	-	-
Plot a drawing for given part model/assembly.	3	-	1	1	-	-	-	-	-
Print components using 3D Printer/Rapid prototyping machine.	3	-	1	1	-	-	-	-	-

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Drawing Hall for Engineering Graphics* by the Institute in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Relevant COs
1	Prepare drawing template consisting of Name plate boundary lines and projection symbol.	CO1
2	Draw and print one simple and one complex 2D geometries using sketcher commands	CO1
3	Draw and print the given two simple 3-D drawings using 3D modeling commands	CO2
4	Draw and print the production drawing of the 3D part models of individual components of Bench vice/ Drill Jig/ Screw Jack *I* Tool Post *I* any assembly	CO2

	consisting of at least five parts. (Problem-I)	
5	Draw and print the production drawing of the 3D part models of individual components of Bench vice/ Drill Jig/ Screw Jack *I* Tool Post *I* any assembly consisting of at least five parts. (Problem -I continued)	CO2
6	Draw and print the production drawing of the 3D part models of individual components of Bench vice/ Drill Jig/ Screw Jack *I* Tool Post *I* any assembly consisting of at least five parts. (Problem -I continued)	CO2
7	Assemble and print the orthographic views of the assembly, bill of materials of Bench vice/ Drill Jig/ Screw Jack/ Tool Post *I* any assembly consisting of at least five parts. (Problem - I)	CO3
8	Assemble and print the orthographic views of the assembly, bill of materials of Bench vice/ Drill Jig/ Screw Jack/ Tool Post *I* any assembly consisting of at least five parts. (Problem - I continued)	CO3
9	Draw and print the production drawing of the 3D part models of individual components of Bench vice/ Drill Jig/ Screw Jack/ Tool Post *I* any assembly consisting of at least five parts. (Problem - II)	CO4
10	Draw and print the production drawing of the 3D part models of individual components of Bench vice/ Drill Jig/ Screw Jack/ Tool Post *I* any assembly consisting of at least five parts. (Problem - II continued)	CO4
11	Draw and print the production drawing of the 3D part models of individual components of Bench vice/ Drill Jig/ Screw Jack *I* Tool Post *I* any assembly consisting of at least five parts. (Problem – II continued)	CO4
12	Assemble and print the orthographic views of the assembly, bill of materials of Bench vice/ Drill Jig/ Screw Jack/ Tool Post/ and assembly consisting of at least five parts. (Problem - II)	CO5
13	Assemble and print the orthographic views of the assembly, bill of materials of Bench vice/ Drill Jig/ Screw Jack/ Tool Post *I* any assembly consisting of at least five parts. (Problem - II continued)	CO5
14	Print simple component using 3D printer/ Rapid prototyping machine.	CO6
15	Print simple component using 3D printer/ Rapid prototyping machine.	CO6
16	Print a complex component using 3D printer/ Rapid prototyping machine.	CO6
17	Print a complex component using 3D printer/ Rapid prototyping machine. (Experiment no 16 continued)	CO6

Note

A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of

which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

ii. Theory

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEH414-1 *Prepare 2D Drawing using sketcher workbench of any parametric CAD software.*			
1.	**Working in 2D environment.** 1.1 Drawing tool: Line, Rectangle, Circle, Arc, Ellipse, Spline, etc. 1.2 Editing tool: Trim, Extend, Erase, Mirror, etc. 1.3 Modify tool: Chamfer, Fillet, Copy, Move, etc. 1.4 Linear, angular dimensions. 1.5 Dimensioning constraint and Geometrical constraint. 1.6 Drawing template: prepare drawing template consisting of Name plate boundary lines and projection symbol.		-
Course Outcome MEH414-2 Generate 3D Solid models from 2D sketch using Part workbench of any parametric CAD software.			
2.	**Development of Solid Models.** 2.1 Working in 3D environment: Creating 3D Solid Models of simple machine parts. 2.2 Part tool: Extrude, Hole, Revolve, Rib, Sweep, Swept, Pattern, etc. 2.3 Part Editing tool: Trim, Extend, Erase, Mirror, 2.4 Part Modify tool: Chamfer, Round, Copy, Move, Draft, etc. 2.5 Intersect 2 solid components by inserting new body option. Boolean operations: Union, subtract, intersection.		-
Course Outcome MEH414-3 *Prepare assembly of part models using Assembly workbench of any parametric CAD software.*			
3.	**Computer aided Assembly** 3.1 Assembly drawing, preparation of assembly drawing by using assembly command 3.2 Exploded view: Explode the assembly.		-

SECTION –II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome MEH414-4 *Generate orthographic views of 3D solid models/assemblies using drafting workbench of any parametric CAD software.*			
4.	**Drafting of3D assembly** 4.1 Orthographic projections: Generate orthographic projections of the assembly. 4.2 Bill of material: Prepare pa11 list table.		-
Course Outcome MEH414-5 *Plot a drawing for given part model/assembly.*			
5.	**Plotting** 5.1 Printer selection, paper size, orientation. 5.2 Page set up.		-
Course Outcome MEH414-6 *Print components using 3D Printer/Rapid prototyping machine.*			
6.	**Additive Manufacturing** 6.1 Additive manufacturing: 3D printing, Rapid prototyping. 6.2 File format: STL (Stereo Lithography). 6.3 3D printer software: pm1impmi, orientation, processing and printing.		-
Total			
Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G: List of Assignments under SLA

Assignments questions on each chapter should be given under SLA. At least 3-4 questions in each assignment.

H: Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to engineering drawing	2	0	4	06	CCH107-1
I / 2	Engineering curves	0	12	6	18	CCH107-2
I / 3	Projection of point and lines	0	10	0	10	CCH107-3
II /4	Projection of planes	0	10	0	10	CCH107-4
II /5	Orthographic projections	0	14	0	14	CCH107-5
II / 6	Sectional views	0	12	0	12	CCH107-5
	Total Marks				**70**	

I: -Assessment Criteria

i) Formative Assessment of Practical: -

Every practical submission shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Correctness and understanding	10
Psychomotor	Line work and neatness	05
	Proper use of instruments	05
Affective	Dimensioning and judgment without measurement	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Term End practical submission shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Correctness and understanding	10
Psychomotor	Line work and neatness	05
	Proper use of instruments	05
Affective	Dimensioning and judgment without measurement	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J: - Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and solids for demonstration

K: - Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

S.N.	Author	Name of Book	Publication
1	Sham Tickoo	CATIA V5Rl 7 for	Softcover, Cadcim Technologies
2	Sham Tickoo	Designers	Softcover, Cadcim Technologies
3	Sham Tickoo	Pro/Engineer Wildfire for	
4	Sham Tickoo	Designers	Softcover, Cadcim Technologies
5	Sham Tickoo	Solid Works For	Softcover, Cadcim Technologies
6	Sham Tickoo	Designers Release 2006	Softcover, Cadcim Technologies

M. SOFTWARE/LEARNING WEBSITES

1. http://www.solidworks.in/sw/products/3d-cad/3d-solid-modeling.htm
2. http://web.iitd.ac.in/~hegde/cad/lecture/L30_solidmod_basics.pdf
3. https://en.wikipedia.org/wiki/Solid_modeling
4. http://npkauto.com/solid-modeling/
5. https://www.youtube.com/watch?v=vjX4PDJcFOI
6. https://www.youtube.com/watch?v=5BDHS4FN2-
7. https://www.youtube.com/watch?v=JjKs-lePlPY

*****

COURSE ID: ME
Course Name : FOUNDRY TECHNOLOGY
Course Code : MEH504
Course Abbreviation : HFTL

A. LEARNING SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN`	
03	30	70	100	40	25	10	25#	10	25	10	175

-External Assessment

C. ABBREVIATIONS: - CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination . (TNR 12 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE:

This subject will enable the students to understand principles behind designing a Gating system to produce a sound casting. This subject includes the considerations of designing a casting on the basis of systematic study of the various processes in the foundry.

iv) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH504-1 Develop the skill of casting method.

MEH504-2 Apply the principle of casting design.

MEH504-3 Analyze casting defect.

MEH504-4 Identify the foundry mechanization and apply in the foundry industry.

MEH504-5 Recognize the principle and functions in foundry management.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": nocorrelation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic& Discipline specific knowledge	**PO 2 Problem analysis**	**PO 3 Design/development of solutions**	**PO 4 Engineering Tools, Experimentation & Testing**	**PO 5 Engineering practice for society, sustainability & environment**	**PO 6 Project management**	**PO 7 Life-long learning**	**PSO1 Work in mfg & service sector**	**PSO 2 Start entrepreneurial ativity**
Competency	3	3	2	2	1	1	-	1	1
MEH504-1	3	3	-	2	-	-	-	1	1
MEH504-2	3	2	3	3	1	1	-	1	1
MEH504-3	2	3	2	2	2	1	-	1	1
MEH504-4	2	2	2	3	1	1	-	1	1
MEH504-5	1	2	2	3	1	3	-	1	1

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted as Laboratory Work in practical sessions of batches of about 25 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Design calculations for methoding data	Calculations for sprue, runner, ingrate	MEH504-1
2	Design calculations for methoding data	Calculations for sprue, runner, ingrate	MEH504-2
3	Design calculations for methoding data	Calculations for sprue, runner, ingrate	MEH504-2
4	Drawing a layout for a small / medium foundry	To understand the layout of the various foundries	MEH504-3
5	Guidelines for design of casting.	To understand the suitable designs for the casting	MEH504-3

ii) THEORY:

SECTION I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome*MEH504-*1 *Develop the skill of casting method.*			
1	**GATING** 1.1 Elements of gating system, 1.2 Fundamentals of fluid flow, Bernoulli's Theorem, 1.3 Design of gating system, Types of gates, 1.4 Slag trap &filters with different cast metals and alloys. 1.5 Methoding of casting, pouring time calculation, Choke area calculation, Size calculation of pouring basin, 1.6 Sprue, Runner &Ingates, Slag trapping arrangements.	**06**	**10**
Course Outcome* MEH504-*1 *Develop the skill of casting method.*			
2.	**RISERING** 2.1 Design of feeding system (Risers), 2.2 Requirement and positioning of risers, 2.3 Range of feeding, 2.4 Feeding efficiency, 2.5 Riser design by Caine's method, 2.6 NRL method, Modulus method, Feeding distances.	**08**	**08**
Course Outcome*MEH504-*2 *Apply the principle of casting design.*			
3	**SOLIDIFICATION OF CASTING** 3.1 Controlled solidification or directional solidification, Progressive solidification,	**10**	**08**

	3.2 difference in quality of casting due to directional & progressive solidification, 3.3 Methods of achieving directional solidification, 3.4 Effect of gating system &risers in achieving directional solidification, 3.5 Use of chills, padding, exothermic material to achieve Directional solidification.		
Course Outcome*MEH504-*2 *Apply the principle of casting design.*			
4	**INTRODUCTION TO CASTING DESIGN** 4.1 Casting design aspects- design for economic moulding, 4.2Design for overall manufacture, 4.3 Design problem related to sections/design of die casting- 4.4 Design fundamentals.	**06**	**08**
	Total	**30**	**34**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome*MEH504-*3 *Analyze casting defect.*			
5	**CASTING DEFECTS ANALYSIS** 5.1 Parameters responsible for casting defects: Design of casting & pattern, pattern & core box equipment, moulding and core making equipment, gating and risering, moulding sand and core sand, melting and metallurgy, pouring, fettling and heat treatment. 5.2 Casting Defects: a) Gas defect- pin holes, blow holes, tears. b) Shrinkage defects- primary and secondary shrinkage, shrinkage, porosity. c) Metallurgical defects- hard spots, chilling, inverse chill, open grain, porosity. d) Defects related to sand practice and gating system –scab, cuts and washes, inclusion, swelling, rough surface, fusion, penetration. e) Mis run and cold shut. f) Mechanical defects-crush, drop, run out shift, flashes. g) Misc-Defects- short pours, leakage etc. 5.3 Analytical approach for trouble shooting- 5.4 Keen observations, importance of records and documentation, importance of process controls. 5.5 Salvaging castings, impregnation.	**14**	**22**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome*MEH504-*4 *Identify the foundry mechanization and apply in the foundry industry.*			
6	**FOUNDRY MECHANIZATION** 6.1 Mechanical equipments in foundry, 6.2 Sand handling & conveying, 6.3 Moulding machines, mechanical equipment for finishing, 6.4 Foundry layout for small, medium scale & large-scale foundries, 6.5 Safety and Accident prevention**.**	**09**	**08**
Course Outcome* MEH504-*5 *Recognize the principle and functions in foundry management.*			
7	F**OUNDRY MANAGEMENT** 7.1 Principles & Functions of Management, incentive schemes, 7.2 Quality consciousness through quality circle program, 7.3 Production planning & control, value analysis 7.4 Material Management: Integrated approach, Organizations and functions of purchase and store, Control of stores, Inventory control, Vendor Development-Terms of contract.	**07**	**06**
	Total	**22**	**36**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

G. LIST OF ASSIGNMENTS UNDER SLA

Assignments questions on each chapter should be given under SLA. At least 3-4 questions in each assignment.

H. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
I/1	Gating	06	02	02	**MEH504**-1	10
I/2	Risering	04	02	02	**MEH504**-1	08
I/3	Solidification of Casting	04	04	02	**MEH504**-2	08
I/4	Introduction to Casting Design	04	02	02	**MEH504**-2	08
II/5	Casting Defects Analysis	14	04	04	**MEH504**-3	22

II/6	Foundry Mechanization	02	02	02	**MEH504**-4	08
II/7	Foundry Management	02	02	02	**MEH504**-5	06
TOTAL		36	18	16		70

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

I. Assessment Criteria

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	05
TOTAL		25

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	05
3	Neat & complete Diagram.	05
4	Observations & handling of instrument.	05
5	Oral Based on Lab work and completion of task	05
	TOTAL	25

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. INSTRUCTIONAL METHODS:

i) Lectures cum Demonstrations
ii) Classroom practices
iii) Use of projector and soft material for demonstration

K. Teaching and Learning resources:

Chalk board, LCD presentations, Audio presentations, Item Bank

L. REFERENCE BOOKS

	Author	Title	Publisher
1.	P. C. Mukherji	Fundamentals of Metals and Casting	Oxford & IBH Pub. Co
2.	T Ramana Rao	Metal casting principles and Practices	New Age International
3.	R. Wlodawer	Directional Solidification of Steel Casting	Elsevier
4.	P.N. Rao	Manufacturing Technology - Forming, Foundry and Welding	Tata McGraw-Hill Education
5.	Heine, Loper& Rosenthal	Principles of Metal Casting	Tata McGraw-Hill Education

M. Learning Website & Software

a. http://www.nkn.in/efoundry.php
b. http://www.indianfoundry.org/
c. http://www.nifft.ernet.in/

*****

COURSE ID : ME
COURSE NAME : TOOL ENGINEERING
COURSE CODE : MEH505
COURSE ABBREVIATION: HTEG

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN`	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Sem.: Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.(TNR 12 font)

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4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

This subject is classified as technology subject. It is intended to impart concepts, principles and procedures of tool engineering to the students so that they can understand the procedure of tool design to achieve highest productivity and perform duties as a technician in tool room, shop floor, quality control. The student can work as supervisor in plastic molding shop and as a sales engineer in tool industry.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Select proper cutting tool from Manufacturers catalogue find its tool life

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH505.1- Select cutting tools and its material using data book and manufacturer's catalogue.
MEH505.2- Estimate tool wear and tool life.
MEH505.3- Describe press tools and dies.
MEH505.4- Design strip layout for given component.
MEH505.5– Select cutting fluid for machining process.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme Outcomes Pos and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency:	1	-	-	3	1	-	-	1	-
MEH505-1	1	-	-	3	-	-	-	1	-
MEH505-2	1	-	1	3	-	-	-	1	-
MEH505-3	1	-	-	3	1	-	-	1	-
MEH505-4	1	-	1	3	-	-	-	1	-
MEH505-5	1	-	1	3	-	-	-	1	-

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Drawing Hall for Engineering Graphics* by the Institute in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Relevant Cos
1	Report on Visit to press shop for study of presses.	CO3
2	Sketches of Combination Die, Progressive Die, and Compound die, Inverted Die, Drawing Die, and Bending Die.	CO1
3	Drawing of strip layout of simple component (Different component for every student),	CO4
4	and calculation of material utilization factor.	CO3
5	ketches of Injection, Moulding die, Pressure diecasting die, forging die.	CO2
6	wo problems on calculation of Cutting forces and shear angle based on Merchant's circle.	CO3
7	One assignment each on development of blank length for bending operation and single stroke drawing operation.	CO1
8	One problem on Selection and designation of carbide tools based on different machining processes.	CO1
9	Sketches of different types of cutting tools showing details of tool angles.	CO3

ii. Theory

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome: MEH505-1 Select cutting tools and its material using data book and manufacturer's catalogue. MEH505.5 –Select cutting fluid for machining process.			
1.	**METAL CUTTING** 1.1 Mechanics of Metal cutting: requirements of tools, cutting forces 1.2 Types of chips, chip thickness ratio, shear angle (Simple Numericals) 1.3 Types of metal cutting process: Orthogonal, oblique and form cutting. 1.4 Cutting fluids: Types, characteristics and applications.	**14**	**12**
Course Outcome: MEH505-1 Select cutting tools and its material using data book and manufacturer's catalogue.			
2.	**CUTTING TOOL GEOMETRY** 2.1 Single point cutting tool, drills, reamers, milling cutters.	**03**	**06**
Course Outcome: MEH505-1 Select cutting tools and its material using data book and manufacturer's catalogue.			
3.	**TOOL MATERIALS** 3.1 Types, characteristics, applications. 3.2 Heat treatment of tool steels, • 3.3 Specification of carbide tips, Types of ceramic coatings.	**07**	**08**
Course Outcome MEH505.2- Estimate tool wear and tool life.			
4	**TOOL WEAR** 4.1 Tool wear, Types of wear, 4.2 Tool life, Tool life equations. 4.3 Machinability: definition, factors affecting machinability, machinability index.	**06**	**08**

SECTION –II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome MEH505.3- Describe press tools and dies.			
5	**PRESS TOOLS** • 5.1 Presses: Introduction, Types, Specification.	**04**	**04**

Course Outcome MEH505.3- Describe press tools and dies.			
6	**TYPES OF DIES AND CONSTRUCTION** 6.1 Simple Die, Compound Die, Progressive Die, Combination die. 6.2 Punch & die mountings, pilots, strippers, miss feed detectors, Pressure Pads, Knock outs, stock guide, Feed-Stop, guide bush, guide pins.	**06**	**08**
***Course Outcome* MEH505.4 -** Design strip layout for given component.			
7	**DIE DESIGN FUNDAMENTALS** 7.1 Die Operations: blanking, piercing, shearing, cropping, notching, lancing, coining, embossing, stamping, curling, drawing, bending, forming. 7.2 Die set, Die shoe, Die area 7.3 Calculation of clearances on die and punch for blanking And piercing dies, Strip layout 7.4 Calculation of material utilization factor.	**06**	**08**
***Course Outcome* MEH505.4 -** Design strip layout for given component.			
8	**FORMING DIES** 8.1 Bending: methods, Bending Dies, bend allowance, spring back, spanking, bending pressure, pressure pads, and development of blank length. 8.2 Drawing: operations, Metal flow during drawing. 8.3 Calculation of Drawing blank size, variables affecting metal flow during drawing, 8.4 Single action and double action dies, combination dies.	**08**	**10**
***Course Outcome* MEG508.5–** Select cutting fluid for machining process.			
9	**FUNDAMENTALS OF OTHER TOOLS** 9.1 Constructional features of: Pressure Die casting dies, metal extrusion dies, injection Moulding dies, forging dies, plastic extrusion dies.	**06**	**06**
Total		**60**	**70**
1. Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G. LIST OF ASSIGNMENTS UNDER SLA

Assignments questions on each chapter should be given under SLA. At least 3-4 questions in each assignment.

H. Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	METAL CUTTING	4	12	0	12	MEH505-1
I / 2	CUTTING TOOL GEOMETRY	0	06	0	06	MEH505-1
I / 3	TOOL MATERIALS	0	10	0	08	MEH505-1
I / 4	TOOL WEAR	0	04	04	08	MEH505-2
II /5	PRESS TOOLS	0	04	06	04	MEH505-3
II /6	TYPES OF DIES AND CONSTRUCTION	02	06	0	08	MEH505-3
II / 7	DIE DESIGN FUNDAMENTALS	04	06	0	08	MEH505-4
II / 8	FORMING DIES	0	06	06	10	MEH505-4
II / 9	FUNDAMENTALS OF OTHER TOOLS	0	06	0	06	MEH505-5
	Total Marks				**70**	

I: -Assessment Criteria

i) Formative Assessment of Practical: -

Every practical submission shall be assessed for 25 marks as per following criteria:

Sr No	Particulars	Marks out of 25
1	Correctness and understanding	10
2	Line work and neatness	05
	Proper use of instruments	05
3	Dimensioning and judgment without measurement	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Domain	Particulars	Marks out of 25
1	Correctness and understanding	10
2	Line work and neatness	05
	Proper use of instruments	05
3	Dimensioning and judgment without measurement	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation (neat figures/ drawing etc.)	05
3	Drawing / drafting skills	10
4	Understanding	05
	TOTAL	**25**

J. Instructional Methods:

1. Lectures
2. Class room practices.
3. Use of projector

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

S.N.	Author	Name of Book	Publication
1	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
2	B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat rai & Sons
3	R. K. Jain	Production Technology	Khanna Publication New Delhi
4	Production Technology	Hindustan Machine Tools (HMT)	Tata Publication

M) Learning Website & Software

1) http://nptel.ac.in
2) www.egr.msu.edu/~pkwon/me478
3) www.basicmechanicalengineering.com/lathe~machine~operation~basic:turning.operations
4) www.planomillers.com/drilling.machine.html
5) www.jsw.co.in/en/products/injectionmoulding
6) www.opm.gov/fedclass/fws3869.pdf

*****

COURSE ID : ME
COURSE NAME : AUTOMBILE ENGINEERING
COURSE CODE : MEH506
COURSE ABBREVIATION: HAEN

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL Practical				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN`	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Sem.: Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

Automobile Engineering a technology subject helps to meet the need of automotive industry for specialized technicians. Due to liberalization of industrial policy in India, major global players in Automobile sector have launched their product in India. It is a key driver of countries economy. It has major employment potential for diploma holders. Automobile servicing in particular offers good job opportunities at village, town and city level. Thus, helps to generate self-employment in country.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1.Understand constructional features and working principle of various automobile systems.
2.Inspect, identify and troubleshoot automobile problems.
3.Develop attitude towards (i) Safety (ii)Punctuality in maintenance schedule.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH506 CO1 - Use appropriate tools for vehicle service operation.
MEH506 CO2 - Carryout repairing activities by following laid down procedures.
MEH506 CO3 - Diagnose faults in given automobile control systems.
MEH506 CO4 - Locate faults in suspension / wheels and tyres system of given automobile.
MEH506 CO5 - Carryout appropriate test for given auto electrical and electronic components.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Work in mfg. & service sector	PSO 2 Start entrepreneurial activity
Competency: 1. Understand constructional features and working principle of various automobile systems.	3	-	-	1	1	-	-	-	-
MEH506.1	3	-	-	-	-	-	-	-	-
MEH506.2	3	-	1	-	-	-	-	-	-
MEH506.3	3	-	-	1	1	-	-	-	-
MEH506.4	3	-	1	-	-	-	-	-	-
MEH506.5	3	-	1	1	-	-	-	-	-

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Automobile Engineering laboratory for Automobile Engineering by* the Institute in practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Relevant COs
1	Prepare a layout of vehicle available in your Laboratory.	CO1
2	Maintain given automobile component using various Service Tools.	CO1
3	Preventive / Scheduled maintenance of four-wheeler/two-wheeler as per manufacturer's specifications /using service manual. maintenance, testing etc.	CO1
4	Demonstration of dismantle, inspect and reassemble the Single Plate Clutch. (Coil Spring Type/Diaphragm Type)	CO2

5	Demonstration of dismantle, inspect and reassemble the Synchromesh Gear Box / constant mesh gear box.	CO2
6	Demonstration of dismantle, inspect and reassemble the Propeller shaft Assembly.	CO2
7	Demonstration of dismantle, inspect and reassemble the Differential Assembly.	CO2
8	Demonstration of dismantle, inspect and reassemble the Drum/Disc Brake.	CO2
9	Demonstration of dismantle, inspect and reassemble the Steering Gear box. (Rack & Pinion/Recirculating Type/Worm and Wheel).	CO3
10	Demonstration of dismantle, inspect and reassemble the Power Steering system. (Hydraulic/ Electronic Type).	CO3
11	Demonstration of dismantle, inspect and reassemble the Leaf Spring assembly.	CO4
12	Demonstration of remove, inspect and refit the Wheel and Tyre assembly.	CO4
13	Demonstration of test a Lead Acid Battery for Open Voltage and Specific Gravity.	CO5
14	Demonstration of dismantle, inspect and reassemble the Distributor used in Battery Ignition System.	CO5
15	Demonstration of a simple electrical circuit for Automobile applications like Lighting/Horn/Wiper/Flasher/Indicators/Gauges etc.	CO5
16	Mini project- Title-Advances in Automobile Engg. such as MPFI, TPFC, VTEC, Use of microprocessor. Automobile fuels such as ethanol, biodiesel, Battery, solar, etc. Able to gain latest knowledge in this subject.	CO5

Note: Minimum 80 % of above list of lab experiment are to be performed.

ii. THEORY

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **MEH506 -1** Use appropriate tools for vehicle service operation.			
1.	**Topic - I Introduction to Automobile** 1.1 Automobile: Definition, Major Components of Automobiles with their functions. 1.2 Classification of Automobiles on the basis of Purpose, Load capacity, Fuels used, based on drive, no. of wheels and axles, transmission, Suspension. 1.3 Vehicle Layout: Significance of vehicle Layout, Different types of vehicle layout, Front Engine Front Wheel Drive, Front Engine Rear Wheel Drive, Rare Engine Rear Wheel Drive, Four Wheel Drive. (FEFWD, FERWD, RERWD, 4WD), Advantages and Disadvantages. 1.4 Function of Chassis, Frame and Body: Chassis components, Functions of frame, Loads acting on the frame, Advantages, disadvantages and types of frames (Conventional frame, sub-frames, unitized frame or frameless construction), Requirements of Body, different types of body styles. 1.5 Electric & Hybrid Vehicle: Needs, components and their Functions. 1.6 Development of Automobiles from Ancient time. (IKS) (No Theory question)	**07**	**10**
Course Outcome **MEH506 - 2** Carryout repairing activities by following laid down procedures.			
2.	**Topic - II Automobile Transmission system** 2.1 Transmission System Layout, components and its application: Layout of two-wheel drive transmission system (2WD) and four-wheel drive transmission system (4WD) and application. 2.2 Clutch: Function and Necessity, Requirement, classification, working principle, construction and working of Single plate (Coil Spring and Diaphragm) clutch, Multiplate Clutch. 2.3 Gear Box: Manual Transmission, Classification, Construction and working of Constant Mesh Gear Box and Synchromesh Gear Box. Automatic transmission, Torque converter, Epicyclic Gearbox (Gear Train). 2.4 Propeller Shaft: Functions and Necessity, Construction of propeller shaft, Functions of universal joint and slip joint 2.5 Differential: Function and Necessity, construction and working principle. 2.6 Axle: Front axle Construction and requirements, Types of (Front) Stub axle, construction and functions of Semi floating, fully floating type of rear axle.	**08**	**12**

Coue Outcome **MEH506.3** Diagnose faults in given automobile control systems.			
3.	**Topic - III Automobile Control Systems** 3.1 Braking System: Function and Braking Requirements, Classification of brakes. Construction and working of Drum and Disc Brakes. Working of Mechanical, Hydraulic and Air brake system. 3.2 Major Components of Hydraulic braking System: Master Cylinder, Wheel cylinder. 3.3 Antilock brake system (ABS): Introduction 3.4 Steering System: Function and Requirements, Construction of steering linkages for rigid axle and independent suspension systems. 3.5 Steering Gear box: Types, Construction and working of Rack and pinion, Recirculating ball type steering gear box, Necessity and principle of power steering. 3.6 Steering Geometry: Castor, camber, Toe-in, Toe-out, King pin inclination, understeer and over steer.	**08**	**12**

SECTION –II

Sr. No	**Topics**	**Teaching (Hours)**	**Theory evaluation Marks**
Course Outcome **MEH506.4** Locate faults in suspension / wheels and tyres system of given automobile.			
4.	**Topic - IV Automobile Suspension** 4.1 Suspension Systems: Function and Requirements, Rigid axle suspension system (Leaf Spring) construction. 4.2 Independent suspension system Introduction, Types of Independent suspension system. Construction and working of Mac-pherson strut type, wishbone type of suspension system. 4.3 Shock Absorber and Air Suspension: construction and working of Telescopic shock absorber, construction and working of Air suspension system.	**06**	**12**
Course Outcome **MEH506.4 -** Locate faults in suspension / wheels and tyres system of given automobile.			
5.	**Topic - V Automobile wheels and tyres** 5.1 Wheels, Rims and Tyres: Function and requirement of wheels. Types of wheels 5.2 Tyre cross section: Cross Ply, Radial ply and belted bias, Tyre designation, Factors affecting tyre life. 5.3 Wheel Alignment and Wheel balancing: Purpose of wheel alignment, Procedure of wheel alignment. Purpose of wheel balancing and procedure of wheel balancing.	**08**	**10**

Course Outcome **MEH506-5** Carryout appropriate test for given auto electrical and electronic components.			
6.	**Topic- VI Introduction to Auto Electrical Systems** 6.1 Introduction to Battery and its components: Function and Requirements of battery, Types of battery, Battery components and working, Battery Rating and Battery Capacity. 6.2 Starting System and charging system: Functions and Requirement of starting and charging system, starting system components and their functions, Alternator components and their functions. Working Principle of alternator. 6.3 Ignition System: Introduction to various types of Ignition Systems. (Battery Ignition, Magneto Ignition and Electronic Ignition System) 6.4 Miscellaneous: Types of sensors used in Automobile.	**08**	**14**
Total		**45**	**70**
1. Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

G: List of Assignments under SLA

The list of assignment questions is as below

1. Define an automobile. List the major components of an automobile and explain the function of any four components with neat diagrams.
2. Explain vehicle layouts:
   - FEFWD
   - FERWD
   - RERWD
   - 4WD

   Write one advantage and one disadvantage of each layout.
3. Explain the clutch system, Function and necessity of clutch, Construction and working of single plate clutch with neat sketch.
4. Explain gearbox and differential: Working of synchromesh gear box, Function and working principle of differential with diagram.
5. Explain braking system, Function and requirements of brakes Construction and working of hydraulic braking system with neat diagram.
6. Explain steering system, Function and requirements of steering system, Explain rack and pinion steering gear box with sketch.
7. Explain suspension system, Function and requirements of suspension system, Construction of rigid axle suspension system with leaf spring (with neat diagram)
8. Explain independent suspension system, Types of independent suspension systems Construction and working of MacPherson strut suspension *(diagram expected)*
9. Explain wheels and tyres, Function and requirements of wheels, Types of wheels, Factors affecting tyre life
10. Explain wheel alignment and balancing, Purpose of wheel alignment, Purpose of wheel balancing, Write the basic procedure of wheel alignment

11. Explain automobile battery, Function and requirements of battery, Types of batteries used in automobiles, Battery rating and battery capacity
12. Explain starting and charging system, Functions of starting and charging system, Main components of starter motor and alternator with their functions, Working principle of alternator (simple explanation)

H: SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction to Automobile	02	02	6	10	MEH 506-1
I / 2	Automobile transmission System	04	04	08	12	MEH 506-2
I / 3	Automobile Control Systems	00	04	06	12	MEH 506-3
II /4	Automobile suspension	02	04	06	12	MEH 506-4
II /5	Automobile wheels and tyres	02	02	06	10	MEH 506-5
II /6	Introduction to Auto Electrical Systems	02	04	06	14	MEH 506-5
	Total Marks				**70**	

I: -ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every practical submission shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Correctness and understanding	10
Psychomotor	Line work and neatness	05
	Proper use of instruments	05
Affective	Dimensioning and judgment without measurement	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Understanding	05
2	Preparedness for Practical	05
3	Presentation	05
4	Understanding	10
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation and dedication	05
3	Clarity and closeness on topic	05
4	Understanding	10
	TOTAL	**25**

J: - Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and solids for demonstration

K: - Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

S.N.	Author	Name of Book	Publication
1	Dr. Kirpal Singh	Automobile engineering. vol I & II	Standard publishers distributors
2	GBS Narang	Automobile engineering	Khanna publishers
3	N K Giri	Automotive technology	Khanna publishers
4	Crouse, Anglin	Automotive mechanics	Tata McGraw Hill Edu. New Delhi,
5	Ramakrishna K	Automobile Engineering	Prentice Hall India Learning Private Limited (2012)
6	S K Gupta	A Textbook of automobile engineering	S Chand publications

M) Learning Website & Software

1. https://www.youtube.com/watch?v=c3CalfdYZYw&list=PLpe3qgeJLpB2wAoaRSY9_yAeOt7u0LTNd
2. Four Stroke Petrol Engine (Working) हिन्दी || Petrol engine working || how petrol engine works - YouTube
3. http://nptel.ac.in/courses. (NPTEL) – automobile courses
4. https://www.youtube.com/watch?v=rbYRif0Iy0w
5. https://www.youtube.com/watch?v=rbYRif0Iy0w
6. https://www.youtube.com/watch?v=devo3kdSPQY&t=3s
7. https://www.youtube.com/watch?v=M5H7UY55rrw
8. https://www.youtube.com/watch?v=uTeMz6d7hwA
9. https://www.youtube.com/watch?v=W1vOzcBbgfg
10. https://www.youtube.com/watch?v=LCMs-7K8nLk.
11. https://www.youtube.com/watch?v=VFu-6tckyc8.
12. https://www.youtube.com/watch?v=aNGA5Ejq8A4.
13. https://www.youtube.com/watch?v=vOo3TLgL0kM.
14. https://www.youtube.com/watch?v=wCu9W9xNwtI.
15. https://www.saeindia.org/.
16. https://www.araiindia.com/Draft AIS Standards.asp.

*****

COURSE ID : ME
COURSE NAME : INDUSTRIAL ENGINEERING AND QUALITY CONTROL
COURSE CODE : MEH508
COURSE ABBREVIATION: HIEQ

A. LEARNING SCHEME:

Scheme Component		Hours	Credits
Actual Contact Hours / Week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME:

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL PRACTICAL				BASED ON SLA		TOTAL
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR		MAX	MIN `	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Semester: 00 Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If a candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as a fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro projects / assignments / other activities. (Provide list of all assignments here in tabular format. At least 6 to 8 assignments to be given)

D. I) RATIONALE:

In today's highly competitive industrial environment, efficiency and quality are critical for organizational success. Industrial Engineering focuses on process optimization, resource utilization, and system efficiency, while quality control ensures that products and services meet predefined standards. The integration of these two aspects enables industries to minimize waste, reduce costs, enhance product reliability, and improve customer satisfaction. This course plays a crucial role in developing Mechanical Diploma Engineering students with the knowledge and skills required to optimize industrial processes, enhance productivity, and ensure quality in manufacturing and service sectors by using conventional as well as modern computerized methods.

II) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the students to attain the following industry identified outcome through various teaching learning experiences: Apply knowledge & skills related to Industrial Engineering for enhancement of quality & productivity.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH508-1 Prepare the process sheet in a given situation.
MEH508-2 Apply work study techniques for optimizing manufacturing processes.
MEH508-3 Apply quality control tools for monitoring product quality in industrial processes.
MEH508-4 Determine Process Capability using Statistical Quality Control Techniques.
MEH508-5 Choose relevant computer aided quality control / inspection methods for manufacturing.

COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation Levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": No Correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline Specific Knowledge	PO 2 Problem Analysis	PO 3 Design / Development of Solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Work in Mfg. & Service Sector	PSO 2 Start Entrepreneurial Activity
Competency:	3	3	2	-	-		1	3	1
MEH508-1	3	2	2	-	-	2	1	3	1
MEH508-2	3	2	1	-	1	-	1	3	1
MEH508-3	3	3	2	1	1	-	1	3	1
MEH508-4	3	3	2	1	-	-	1	3	1
MEH508-5	3	3	2	3	-	-	1	3	1

F. CONTENT:

i) PRACTICAL EXERCISES

Sr. No.	Laboratory Experiment / Practical Titles / Tutorial Titles	Practical / Tutorial / Laboratory Learning Outcome	Number of Hrs.	Relevant COs
1	Preparation of Plant Layout for Small Scale Industry.	1. Select the activity for time study from given examples. 2. Select the proper equipment for time study. 3. Measure time component involved in operation. 4. Compile measured time for each activity.	2	CO1
2	Part print analysis for manufacturing feasibility.	1. Identify key dimensions, tolerances and surface finish requirements. 2. Evaluate manufacturing feasibility based on part print analysis. 3. Enlist manufacturing operation. 4. Arrange the optimized sequence of operation.	2	CO1
3	Preparation of a detailed process plan for a given manufacturing job.	1. Analyze the given job and interpret its design and manufacturing requirements. 2. Identify suitable manufacturing processes and sequence them appropriately. 3. Select appropriate machines, tools, cutting parameters, and inspection methods. 4. Prepare a comprehensive process plan including operation sheets and process routing.	4	CO1, CO5
4	Record motions of given manufacturing operations using motion study.	1. Select the activity for motion study from given examples. 2. Select the equipment for motion study. 3. Record motion involved in operation.	2	CO2
5	Measure time of given manufacturing operation using time study method.	1. Select the activity for time study from given examples. 2. Select the proper equipment for time study. 3. Measure time component involved in operation. 4. Compile measured time for each activity.	2	CO2
6	Productivity improvement using motions and time study.	1. Identify the essential and excess motions in a given situation. 2. Assess the excess motion and time in a given situation. 3. Prepare a new motion chart by eliminating excess motion time.	2	CO2
7	Construction of a two handed motion chart.	1. Select activity from given examples. 2. Choose appropriate THERBLIGS for motion study. 3. Draw a two handed motion chart.	2	CO2
8	Preparation of multiple activity charts.	1. Prepare multiple activity charts for a given situation.	2	CO2

9	Determination of standard time for given manufacturing operation.	1. Select work to be measured from given examples. 2. Record the time activity wise by observing each activity. 3. Calculate standard time by adding normal time and applicable allowances. 4. Determination of standard time for given manufacturing operation.	2	CO2
10	Pareto chart using computer aided quality control software.	1. Select problem for pareto chart analysis from given examples. 2. Choose any computer aided quality control software. 3. Generate a pareto chart.	2	CO3, CO5
11	Develop a fishbone diagram for a given mechanical problem.	1. Identify a real-world mechanical issue (e.g., machine failure, defective parts, poor surface finish). 2. Choose any computer aided quality control software. 3. Construct a fishbone diagram.	2	CO3, CO5
12	Preparation of variable control charts (X bar and R) for given data and validate using CAQC software.	1. Collect and arrange data. 2. Calculate X bar and R. 3. Calculate UCL and LCL. 4. Draw and interpret variable charts. 5. Validate using CAQC software.	2	CO4, CO5
13	Preparation attribute control charts (P-chart and C-chart) for given data and validate using CAQC software.	1. Collect and arrange data. 2. Calculate P bar and C bar. 3. Calculate UCL and LCL. 4. Draw and interpret attribute charts. 5. Validate using CAQC software.	2	CO4, CO5
14	Determination of process capability and validation using CAQC software..	1. Collect and arrange data. 2. Determine process capability. 3. Validate using CAQC software.	2	CO4, CO5

*Note: Out of above suggestive practical exercises,

- Minimum 12 of the above list of lab experiments are to be performed in which 06 of Industrial Engineering and 06 of Quality Control are compulsory.
- Judicial mix of practical exercises/COs are to be performed to achieve desired outcomes.
- * Marked practical exercises are mandatory.

ii) THEORY

SECTION – I			
Sr. No.	**Topics/ Subtopics**	**Teaching/ Learning (Hours)**	**Classroom Learning/ Theory Evaluation Marks**
***Course Outcome* MEH508-1** *Prepare the process sheet in a given situation.*			
1.	**Topic 1 - Plant and Process Engineering** 1.1 Plant location and layout: Importance of site selection, factors affecting site selection, types of plant layouts, design principles of plant layout, merits and demerits of different plant layouts. 1.2 Production systems: Types of production system, job order production, batch production, mass production, continuous production. 1.3 Productivity: Definition, measurement of productivity, methods of improving productivity. 1.4 Process Engineering: Definition and importance of process engineering, procedure of process planning, factors affecting process planning, operation sheet/route sheet. 1.5 Line balancing: Definition, importance of line balancing. 1.6 Computer Aided Process Planning (CAPP): Introduction, objectives, types, applications, comparison between traditional process planning and CAPP.	**16**	**18**
***Course Outcome* MEH508-2** *Apply work study techniques for optimizing manufacturing processes.*			
2.	**Topic 2 - Work Study** 2.1 Industrial Engineering: Definition, need, objectives and scope. 2.2 Work study: Components of work study, method study (Motion Study) and time study (Work Measurement). 2.3 Method study: Definition, objectives, procedure, factors considered for selection of work for method study. 2.4 Recording techniques of method study: Process charts - outline process chart, flow process chart, two handed process chart/SIMO chart, multiple activity chart, flow diagram, string diagram, therbligs, travel chart. 2.5 Work Measurement: Objectives, procedure, time study, time study equipment, time study allowances. 2.6 Calculation of standard time. (simple numerical on work study)	**14**	**16**

SECTION - II			
Course Outcome **MEH508-3** *Apply quality control tools for monitoring product quality in industrial processes.*			
3.	**Topic 3 - Quality Control** 3.1 Meaning of quality of product and services, importance of quality control, quality characteristics, quality of design, quality of conformance, quality of performance, meaning and importance of quality assurance. 3.2 Quality economics: Cost of quality, value of quality, economics of quality confirmation, cost of quality, appraisal, prevention, external and internal failure cost. 3.3 Quality control tools: Basic concept and areas of application, various Q-C tools, cause-and-effect diagram (fishbone or Ishikawa diagram), check sheet, histogram, pareto chart and scatter diagram. 3.4 Inspection definition and meaning, difference between inspection and quality control, classification of inspection - (i) Inprocess inspection (ii) Final inspection (iii) Raw material inspection. 3.5 Role of quality control inspector / supervisor.	**12**	**14**
Course Outcome **MEH508-*4*** *Determine Process Capability using Statistical Quality Control techniques.*			
4.	**Topic 4 - Statistical Quality Control** 4.1 Definition, objectives and benefits of Statistical Quality Control (SQC) 4.2 Variable and attribute measurement, inherent and assignable sources of variation. 4.3 Control charts for variables: X bar and R charts, control charts for attributes p, np, c charts. 4.4 Process capability of machine (+/-3 sigma or +/- 6 sigma), Cp and Cpk calculations. 4.5 Acceptance sampling concept, comparison with 100% inspection, operating characteristics curve. 4.6 Different types of sampling methods.	**14**	**16**
Course Outcome **MEH508-*5*** *Choose relevant computer aided quality control / inspection method for manufacturing.*			
5.	**Topic 5 - Computer-aided Quality Control** 5.1 Computer Aided Quality Control (CAQC): Introduction, objectives, types, applications comparison between traditional quality control and CAQC. 5.2 Computer Aided Inspection (CAI): Introduction, objectives, applications, comparison between traditional inspection and CAI.	**04**	**06**
Total		**60**	**70**
Summative Assessment: Theory paper should be such that the total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

H. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA:

Suggestive list of assignments, activities and microprojects under Self Learning Assessment (SLA**)** is given here. Similar assignments, activities and microprojects for Self Learning Assessment could be added by the concerned faculty.

1. Industrial Visit to an Automobile manufacturing plant.
2. Collect information and make a report about the Quality Circle forum of India. (QCFI)
3. Collect an information and make a report about different software's used in CAPP, CAQC and CAI.
4. Choose a task (Typing a document, packing items, assembling a small product etc.), record time for each step using a stopwatch, and analyze it. Suggest improvements if any.
5. Analyze the ergonomic setup of a workstation (e.g., Computer desk, Assembly line, Kitchen work area of a Canteen, Machine Shop arrangement, Inspection table). Identify posture issues, repetitive strain risks, and suggest ergonomic improvements.
6. Visit to Small Scale Industry, create a layout to reduce material handling time and improve workflow efficiency.
7. Prepare Wall Chart of 3 Sigma and Six Sigma Curves.
8. Prepare a wall chart using standard Therbligs, Giving meaning of each symbol.
9. Compare Manual Process planning with a computer aided approach.

I. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic No.	Name of Topic	Distribution of Marks (Levelwise)			Total Marks	CO
		Remember	Understand	Apply		
I / 1	Plant and Process Engineering	6	6	6	18	MEH508-1
I / 2	Work Study	4	4	8	16	MEH508-2
II / 3	Quality Control	2	8	4	14	MEH508-3
II / 4	Statistical Quality Control	4	4	8	16	MEH508-4
II / 5	Computer-Aided Quality Control	2	4	0	06	MEH508-5
Total Marks		**18**	**26**	**26**	**70**	

J. ASSESSMENT CRITERIA

I) Formative Assessment of Practical:

Every practical submission shall be assessed for 25 marks as per following criteria:

Sr. No.	Domain	Particulars	Marks out of 25
01	**Cognitive**	Understanding	05
		Application	05
02	**Psychomotor**	Observation table and recording	05
		Interpretation of the result and conclusion	05
03	**Affective**	Discipline, Punctuality and Attendance	05
TOTAL			**25**

II)

Summative Assessment of Practical:

Sr. No.	Particulars	Marks out of 25
01	Preparedness for practicals, understanding and application	05
02	Attendance at regular practicals	05
03	Observation table, recording, calculations, graph/charts	05
04	Interpretation of results and conclusion	05
05	Answer to questions at Oral/ Practical Examination based on Lab work	05
TOTAL		**25**

K. INSTRUCTIONAL METHODS/ LEARNING PEDAGOGIES:

1. Lectures cum Demonstrations
2. Class room practices.
3. Use of projector and solids for demonstration.
4. Presentations, Simulation Video, Demostration Softwares
5. Role Play, Group Discussion, Collaborative Learning, Cooperative Learning
6. Case Study, Survey, Flipped Classroom
7. Control Charts,

L. TEACHING AND LEARNING RESOURCES:

Chalk Board, LCD presentations, Demonstrative kits, Demonstrative charts, Question bank.

M. LEARNING MATERIALS / REFERENCE BOOKS:

Sr. No.	Author	Name of Book	Publication
1	Khanna O.P.	Industrial Engineering and Management	Dhanapat Rai Publications(P) Ltd., New Delhi, (1980), ISBN-10: 818992835X
2	Mahajan M.	Statistical Quality Control	Dhanpat Rai and Sons, New Delhi, (2006) ISBN-10: 817700039X
3	Jain R.K.	Engineering Metrology	Khanna Publishers; Special Edition (1 January 2022); Khanna Publishers, ISBN-10, 978817409 1536 ISBN-13, 978-8174091536
4	M. Groover	Computer-Aided Design and Manufacturing	Pearson Education; 1st edition (1 January 2003); Pearson Education ISBN-10, 8177584162. ISBN-13, 978-8174906700
5	P. N. Rao	Computer-Aided Manufacturing	McGraw Hill Education (1 July 2017) ISBN-10 007463103, ISBN -13, 978-0074631034
6	L. C. Jhamb	Production Planning and Control	Everest Publishing House; 12th Edition (1 January 2010) ISBN-10 8186314725, ISBN-13 978-8186314722
7	T.R. Banga, S.C. Sharma	Industrial Organization and Engineering Economics	Khanna Publication 1 January 2006 ISBN-10 8174090789 ISBN - 13 978-9174090782

N. LEARNING WEBSITE & SOFTWARE:

1. https://youtu.be/6ZevuJlCFBM?si=X5vCK0GAHSlU21m7
2. https://www.youtube.com/watch?v=gJDYV2SmFeY
3. https://www.youtube.com/watch?v=KNFZXNWYVno
4. https://www.youtube.com/watch?v=y6NKspIn2XE
5. http://digimat.in/nptel/courses/video/112107259/L01.html
6. https://www.youtube.com/watch?v=yYIVumq6sVM
7. https://www.youtube.com/watch?v=qb3mvJ1gb9g
8. https://hcmindonesia.wordpress.com/wp-content/uploads/2012/12/introduction-to-work-study.pdf
9. https://www.youtube.com/watch?v=oMEXLiANqMU

*****

COURSE ID : ME
COURSE NAME : WELDING TECHNOLOGY
COURSE CODE : MEH509
COURSE ABBREVIATION: HTEG

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	00	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	08	

B. ASSESSMENT SCHEME: -

PAPER DURATION IN HRS	THEORY				BASED ON LL & TL				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN`	
03	30	70	100	40	25	10	25#	10	25	10	175

(Total IKS Hrs. for Sem.: Hrs.)

C. ABBREVIATIONS:

CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination.(TNR 12 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.

* Self learning includes micro project / assignment / other activities. (Provide list of all assignments here in tabular format At least 6 to 8 assignments to be given)

D. i) RATIONALE: -

As the standard of living continues to improve in most fabrication revolution using both common and more exotic processes, has been created. The exotic type of metal fabrication especially requires use of the most modern welding equipments and techniques.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

1. Use Welding processes for fabrication
2. Apply various types of welding Processes.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MEH509.1- Distinguish different welding processes.
MEH509.2- Select proper welding process for given job
MEH509.3- Demonstrate various types of welding processes
MEH509.4- Interpret welding drawing
MEH509.5– Follow safe practices in welding operations.

Competency, course outcomes and programme outcomes/programme specific outcomes (cp-co-po/pso) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency:	1	-	-	3	1	-	-	1	-
MEH509-1	1	-	-	3	-	-	-	1	-
MEH509-2	1	-	1	3	-	-	-	1	-
MEH509-3	1	-	-	3	1	-	-	1	-
MEH509-4	1	-	1	3	-	-	-	1	-
MEH509-5	1	-	1	3	-	-	-	1	-

F. CONTENT:

i) Practical exercises

The following practical exercises shall be conducted in the *Drawing Hall for Engineering Graphics* by the Institute in practical sessions of batches of about 20- 22 students:

Sr No	**Laboratory Experiment / Practical Titles / Tutorial Titles**	Relevant COs
1	Demonstration of Shield arc welding.	CO3
2	Demonstration of Submerged Arc Welding.	CO3
3	One job on Carbon Arc Welding.	CO3
4	Demonstration of Gas Shield arc welding.	CO3
5	One job on Gas welding.	CO2
6	One job on Gas Cutting (Different profile cutting)	CO3
7	Study of other welding processes.	CO1
8	Welding Symbols.	CO1
9	Study of Care and Safety in welding operation.	CO3
10	Industrial visit to fabrication workshop for Arc welding and Gas welding Gas welding.	CO4
11	Industrial visit for other welding processes.	CO1 CO2 CO3 CO4 CO5

ii. Theory

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course outcome: MEH509.1*-Distinguish different welding processes.* ***MEH509.2-****Select proper welding process for given job* ***MEH09.3-*** *Demonstrate various types of welding processes* ***MEH509.4-*** *Interpret welding drawing* ***MEH509.5****–Follow safe practices in welding operations.*			
1.	**GAS SHIELD ARC WELDING** 1.1 Introduction 1.2 Equipments 1.3 TIG operation 1.4 MIG operation. 1.5 Applications.	**30**	**34**

SECTION –II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course outcome: MEH509.1*-Distinguish different welding processes.* ***MEH509.2-****Select proper welding process for given job* ***MEH509.3-*** *Demonstrate various types of welding processes* ***MEH509.4-*** *Interpret welding drawing* ***MEH509.5****–Follow safe practices in welding operations.*			
2.	**GAS WELDING**. 2.1 Introduction 2.2 Equipments 2.3 Operation 2.4 Joining Processes. 2.5 Oxygen Fuel Cutting. 2.6 Application.	**18**	**20**
3.	**OTHER WELDING PROCESSES** 3.1 Plasma Arc Welding. 3.2 Resistance Welding. 3.3 Electron Welding. 3.4 Laser Welding. 3.5 Thermit Welding. 3.6 Metal Flame Spraying. 3.7 Solid State Bonding. 3.8 Application of Each Type.	**12**	**16**
Total		**60**	**70**

1. Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

** No questions will be asked on IKS learning subtopics in any question papers.

G: LIST OF ASSIGNMENTS UNDER SLA

Assignments questions on each chapter should be given under SLA. At least 3-4 questions in each assignment.

H: Specification table for setting question paper for semester end theory examination

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	**GAS SHIELD ARC WELDING**	10	12	12	34	MEH509-1
II / 2	**GAS WELDING**.	04	10	06	20	MEH509-4
II / 3	**OTHER WELDING PROCESSES**	02	08	06	16	MEH509-5
	Total Marks				**70**	

I: -Assessment Criteria

i) Formative Assessment of Practical: -

Every practical submission shall be assessed for 25 marks as per following criteria:

Sr. No.	Particulars	Marks out of 25
1	Correctness and understanding	10
2	Line work and neatness	05
	Proper use of instruments	05
3	Dimensioning and judgment without measurement	05
TOTAL		**25**

ii) Summative Assessment of Practical:

Domain	Particulars	Marks out of 25
1	Correctness and understanding	10
2	Line work and neatness	05

	Proper use of instruments	05
3	Dimensioning and judgment without measurement	05
TOTAL		**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation and dedication	05
3	Clarity and closeness on topic	05
4	Understanding	10
	TOTAL	**25**

J: - Instructional Methods:

1. Lectures
2. Class room practices.
3. Use of projector

K: - Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

S.N.	Author	Name of Book	Publication
1	Richard L. Little	Welding & Welding Technology	Tata McGraw-Hill.
2	Mohler Rudy	Practical Welding	Industrial Press Inc.

M) Learning Website & Software

i) www.swikuo.com
ii) www.workshopmachinery.com
iii) www.sodick.com/
iv) www.terprisemachinery.co.uk/

*****

COURSE ID: ME
COURSE NAME : REFRIGERATION AND AIR CONDITIONING
COURSE CODE : MEH510
COURSE ABBREVIATION: HRAC
COURSE TYPE : DSC

A. LEARNING SCHEME:

Pre-requisite Course(s): Nil

Teaching Scheme:

Scheme component	Actual Contact Hours / week	Credits
Classroom Learning (CL)	04	**4**
Tutorial Learning (TL)	-	
Laboratory Learning (LL)	02	
Self-Learning Hours (SLH)	02	
Notional Learning (NLH)	08	

B. ASSESSMENT SCHEME:

Theory				Based on LL & TL				Based on Self Learning		Total Marks
				Practical						
FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
30	70	100	40	25	10	25	10	25	10	175

Total IKS Hrs for Sem: 2 Hrs

C. ABBREVIATIONS: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning,
SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment,
SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1(one) credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
   * Self learning includes micro project / assignment / other activities. (Provide list of all 5 assignments here in tabular format)

D. i) RATIONAL:

This subject is classified as an Applied Technology. The 21st century predicts revolutionary developments in Refrigeration and Air Conditioning. Refrigeration and Air conditioning is one of the most meaningful 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 existing 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. The basic Knowledge of Thermal Engineering is required for this subject.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various learning experiences:

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. The basic Knowledge of Thermal Engineering is required for this subject.

F. COURSE LEVEL LEARNING OUTCOMES (CO'S)

MEH 510-1 Understand basics of refrigeration components
MEH 510-2 Describe various refrigerants used in practice
MEH 510-3 Apply values of different psychrometric properties using charts and tables for refrigeration and air-conditioning systems
MEH 510-4 Select appropriate Air conditioning systems for given situation.
MEH 510-5 Calculate cooling load for the particular situation.
MEH 510-6 Develop proper Air distribution systems according to site requirement for the given situation

Competency, course outcomes and programme outcomes/programme specific outcomes (CP-CO-PO/PSO) matrix

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "0"]

Competency and COs	Programme outcome POs and PSO's								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & testing	PO 5 Engineer ing Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
MEH 510.1	3	-	-	-	-	-	-	-	-
MEH 510.2	3	-	1	-	-	-	-	-	-
MEH 510.3	3	-	-	1	1	-	-	-	-

Competency and COs	Programme outcome POs and PSO's								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & testing	PO 5 Engineer ing Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
MEH 520.4	3	-	1	-	-	-	-	-	-
MEH 510.5	3	-	1	1	-	-	-	-	-
MEH 510.6	3	-	1	1	-	-	-	-	-

G. CONTENT:

ii) Practical exercises

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted in the Laboratory practical sessions of batches of about 20- 22 students:

Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Trial on water cooler test rig.	04	CO 1
2	Trial on ice plant test rig.	04	CO 1
3	Visit to cold storage.	04	CO 4
4	Demonstration of domestic refrigerator in View of construction, operation and controls used.	02	CO 1
5	Demonstration of various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC.	02	CO 2
6	Identification of components of hermetically sealed compressor	02	CO 2
7	Visit to repair and maintenance workshop in view of use of various tools and charging procedure.	04	CO 2
8	Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).	02	CO 5
9	Visit to central A.C. plant in view of ducting system, insulation system and Air distribution system (e.g. frozen food industry/ice- cream industry/mushroom plants/textile industries).	04	CO 3
10	Trouble shooting of domestic refrigerator/window air-Conditioner.	02	CO 6

ii) THEORY

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **MEG510.1 Understand basics of refrigeration components**			
1.	**Cooling System Components** 1.1 Refrigeration Compressors: Classifications, Construction and working of Hermetically sealed air compressor, Open type compressor, Rotary compressor, Centrifugal compressor, Screw and Scroll compressor and their applications. 1.2 Condensers: Classifications, Working of Air and Water-cooled condensers, Evaporative condensers, comparisons and applications. 1.3 Evaporators: Classification, Working & Applications of-finned type, Bared tube, Plate type, Flooded, Shell and Tube type evaporators. 1.4 Expansion devices: Classification, Capillary tube, Automatic expansion valve, Thermostatic expansion valve, their selection, working and application.	**14**	**14**
Course Outcome **MEH510.2** *Describe various refrigerants used in practice*			
2.	**REFRIGERANTS** 2.1 Classification of refrigerants. 2.2 Desirable properties of refrigerants. 2.3 Nomenclature of refrigerants. 2.4 Selection of refrigerant for specific applications. 2.5 Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants etc.	**06**	**08**
Course Outcome**MEH510.3***Apply values of different psychrometric properties using charts and tables for refrigeration and air-conditioning systems*			
3.	**PSYCHROMETRY** 3.1 Definition and necessity of air conditioning. 3.2 Properties of Air, Dalton's law of partial pressure. 3.3 Psychrometric chart. 3.4 Psychrometric processes, Bypass Factor, ADP, concept of SHF, RSHF, ERSHF, GSHF. 3.5 Thermal Comfort: Basic parameters, Thermodynamics of human body, Thermal comfort and Comfort charts, Factors affecting thermal comforts. 3.6 Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils.	**10**	**12**

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome **MEH510-4** *Select appropriate Air conditioning systems for given situation.*			
4.	**Air Conditioning Systems** 4.1 Classification of Air conditioning System- Summer and Winter, Year around air conditioning, Unitary air conditioning construction, application & comparison. 4.2 Construction and working of Cassette air conditioning system. 4.3 Central air conditioning- types, Direct and Indirect central air conditioning construction, application. 4.4 Insulations- Purpose, types of insulation, materials and their properties. 4.5 Heating Coils- Types 4.6 Introduction to Automobile Air conditioning system. 4.7 Basic requirements for Installation, testing of HVAC Systems, selection of appropriate Air conditioning systems for given situation with justification.	**14**	**14**
Course Outcome **MEH510-5** *Calculate cooling load for the particular situation.*			
5.	**Cooling Load Calculations** 5.1 Introduction & necessity of Cooling Load Calculations- Energy Efficiency, System Sizing, Occupant Comfort. 5.2 Factors to be considered for cooling load calculations. 5.3 Calculation of Sensible and Latent heat gain sources. 5.4 Cooling load calculation for- Auditorium/ Computer laboratory/ Class room	**06**	**08**
Course Outcome **MEH510-6** *Develop proper Air distribution systems according to site requirement for the given situation.*			
6.	**Ventilation, Infiltration & Air Distribution Systems** 6.1 Ventilation and Infiltration: Natural ventilation, Mechanical ventilation, Concept of Basement Ventilation, Heat Sensors. 6.2 Concept of Air handling unit, Air distribution system- Closed perimeter system, Extended perimeter system, Radial duct system, construction and application of Supply, Return and Make up ducts. 6.3 Duct Design: Definition of duct and types of ducts, Economic factors influencing duct layout, Materials for ducts and its specification, Flow through duct, Pressure in ducts, losses in ducts, Equivalent diameter of a circular duct for rectangular sections, Factors considered for duct design. (Simple numerical on duct design). 6.4 Air Distribution System: : Factors to be considered for Air distribution system, Types of Air distribution	**10**	**14**

	devices. Types of Fans used in air conditioning applications, Types of Supply air outlets, Selection and location of Outlets, Filters, Diffusers, Grills, Blowers and Dampers. Air jet nozzles, Concept of Variable Air Volume (VAV) systems and working.		
Total		**60**	**70**
1. Summative assessment – Theory paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

** No questions will be asked on IKS learning subtopics in any question papers.

I. SUGGESTED MICRO PROJECTS / ASSIGNMENTS/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) UNDER SLA

Assignments questions on each chapter should be given under SLA. At least 3-4 questions in each assignment.

J. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica-tion		
1	COOLING SYSTEM COMPONENTS	02	06	06	MEH 510-1	06
2	REFRIGERANTS	02	04	02	MEH 510-2	18
3	PSYCHROMETRY	02	06	04	MEH 510-3	10
4	AIR CONDITIONING SYSTEMS	02	06	06	MEH 510-4	10
5	COOLING LOAD CALCULATIONS	02	04	02	MEH 510-5	14
6	VENTILATION, INFILTRATION & AIR DISTRIBUTION SYSTEMS	02	06	06	MEH 510-6	12
	Total	12	32	26		**70**

K. ASSESSMENT CRITERIA

i) Formative Assessment of Practical: -

Every assignment shall be assessed for 25 marks as per following criteria:

Sr. No.	Particulars	Marks out of 25
1	Preparedness for practical	05
	Result table / calculations / graphs	05
2	Observation tables	05
	Correct figures / diagrams	05
3	Safety / use of proper tools	05
	TOTAL	**25**

ii) Summative Assessment of Practical:

Sr. No.	Particulars	Marks out of 25
1	Preparedness for practical	10
2	Result table / calculations / graphs	05
	Observation tables	05
3	Correct figures / diagrams	05
	TOTAL	**25**

iii) Assessment of SLA: -

Every Self-learning assignment shall be assessed for 25 marks as per following criteria:

Sr.no	Criteria	Marks allotted
1	Punctuality	05
2	Presentation and dedication	05
3	Clarity and closeness on topic	05
4	Understanding	10
	TOTAL	**25**

K. INSTRUCTIONAL METHODS:

i) Lectures cum Demonstrations,
ii) Class room practices.
iii) Use of projector and soft material for demonstration

L. TEACHING AND LEARNING RESOURCES:

Chalk board, Power Point presentations and Demonstrative kits.

M. REFERENCE MATERIAL:

Sr. No	Author	Title	Publisher
01	R. S. Khurmi	Refrigeration and Air Conditioning	S. Chand and Co
02	Arrora and Domkundwar	Refrigeration and Air Conditioning	Dhanpat Rai and Sons
03	Manohar Prasad	Refrigeration and Air Conditioning	New Age Publications
04	P. N. Ananthanarayanan	Refrigeration and Air Conditioning	Tata McGraw Hill
05	Roy Dossat	Principles of Refrigeration	Pearson Education
06	Edwin P. Anderson	Commercial Refrigeration	Taraporevala Sons & Co

N. LEARNING WEBSITE & SOFTWARE: -

1. http://www.alephzero.co.uk
2. http://www.brighthubengineering.com
3. http://en.wikipedia.org/wiki/Duct_(HVAC)
4. https://youtu.be/YoN5251ta18?si=7t18E4M3uUVgJ_r4
5. https://youtu.be/WM09L5aUuyE? si=rX8vNmF3nxCDOTM-
6. https://youtu.be/YUgN5D-bmpg?si=x6nxT3cwdxwze2mc
7. https://youtu.be/rTBoP8LbTJA?si=2DCzHNZ3E3rJbEhU
8. https://youtu.be/gRcgUfeAHl4?si=5l0EdmQDsYXGy2Q_

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