GOVERNMENT POLYTECHNIC, KOLHAPUR

(An Autonomous Institute of Government of Maharashtra)

Curriculum Document

CURRICULUM: MPECS-2023

(Outcome Based Curriculum)

For

DIPLOMA IN METALLURGICAL ENGINEERING

Secretary **Chairman**

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

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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 has 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 feed back 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 has 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 :

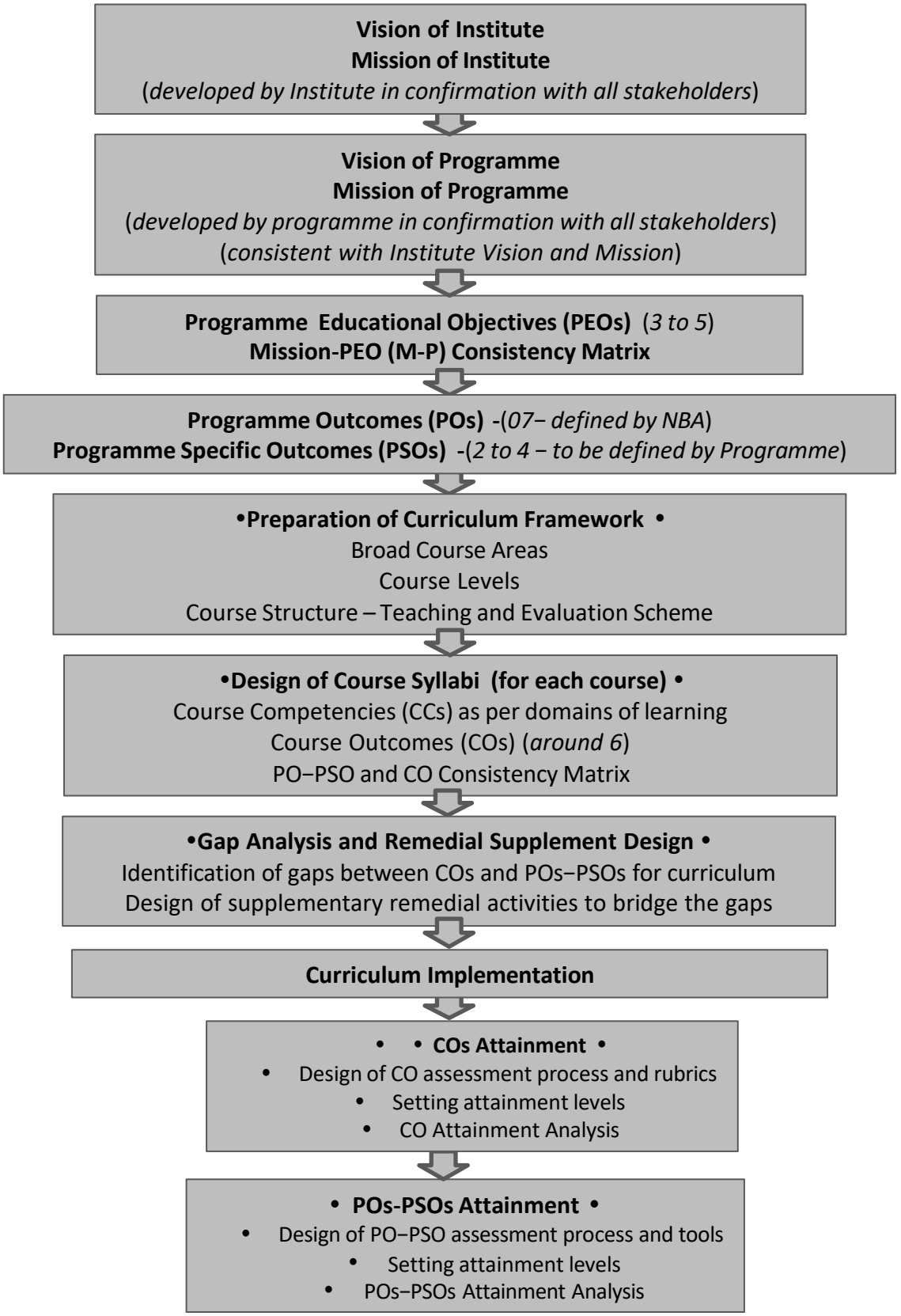
- To define the purpose of education
- To accept systematic planning methods
- To confirm implementation strategies
- To identify and to incorporate needs of industries
- To follow the policy directives
- To cope-up with social concerns
- To aim at personality development of students
- To allow future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



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 13th June 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.

1. 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 seven 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-2020- It is the Curriculum of the Institute revised in the year 2020. It is applicable to the students admitted since 2020

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.

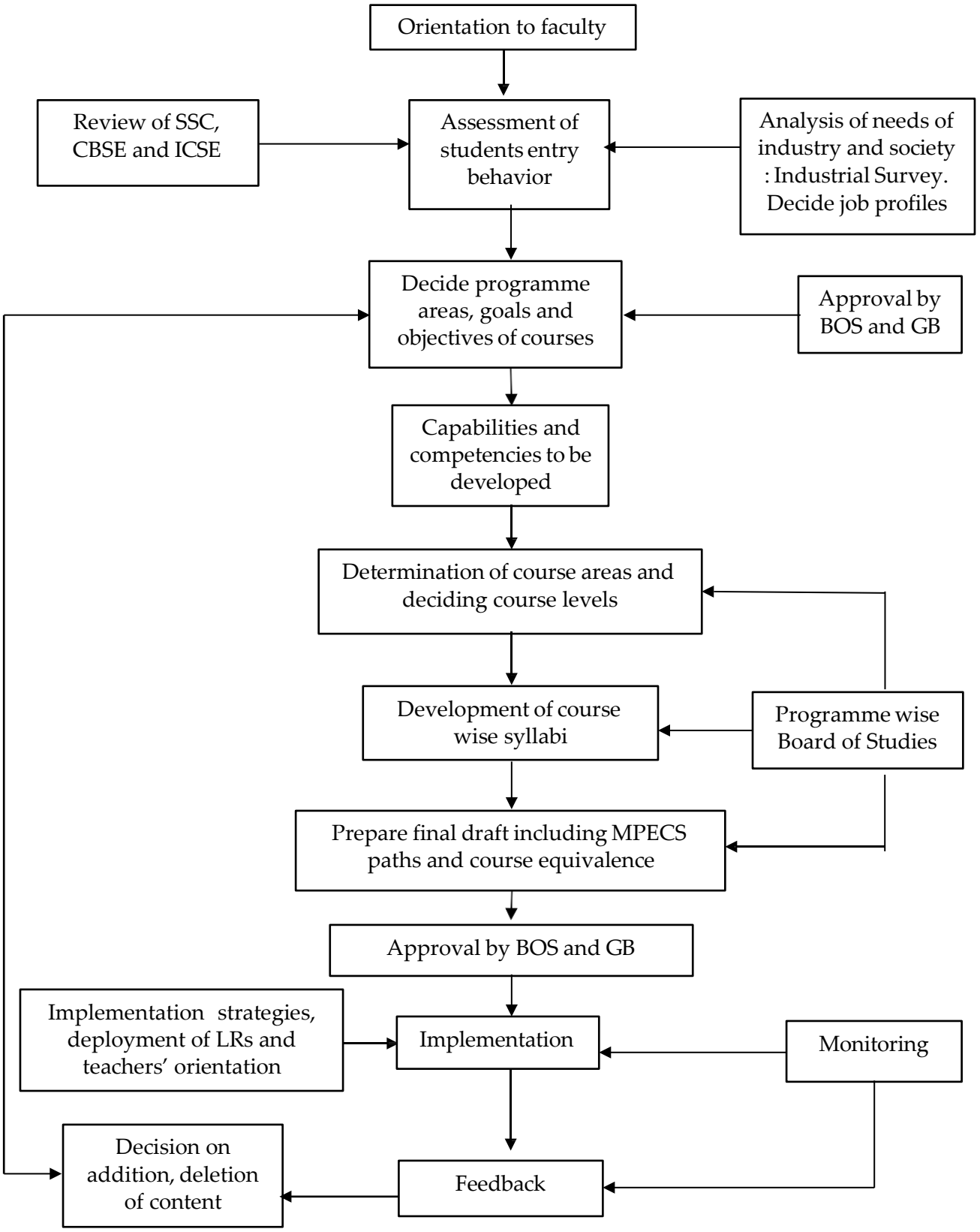
Academic Autonomy and MPECS at Government Polytechnic, Kolhapur –

- Year of award of academic autonomy : 1992 ❑ Year of award of MPECS and Flexibility : 1994

Government Polytechnic, Kolhapur is the first Government Polytechnic in Maharashtra to have been awarded academic autonomy

- 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.
- 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 and entrepreneurship to cater the needs of industry and society.

Mission of Institute:

- To educate and train in multi-disciplinary multi-level programmes to develop competent technicians and skilled manpower for industrial needs
- To ensure employability, encourage entrepreneurship, promote lifelong learning
- To inculcate in 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 and high recognition.

Vision of department:

Valuable contribution in the progress of industries by developing competent metallurgy technicians by offering updated knowledge and skills.

Mission of programme:

1. To collaborate with local industries for providing training and skills to the students.
2. To design, arrange and conduct skill development courses in the field of metallurgy to develop skilled manpower for the industries.
3. To ensure employability, encourage entrepreneurship, promote lifelong learning.
4. To inculcate in students the qualities of a good citizen at individual, social and professional level.

Programme vision supports the Institute vision as below:

SN	Key points of Institute Vision	Key points of Programme Vision	Remarks
1.	High recognition	Skilled technicians serving the industry/society.	Programme vision supports all the key points of the Institute vision as per the different supporting matching phrases shown beside.
2.	Competent technicians	Skilled technicians.	
3.	Quality services	Rendering services in the fields related to Metallurgical Engineering following professional and ethical practices.	
4.	Entrepreneurship	Entrepreneurs in the fields related to Metallurgical Engineering following professional and ethical practices.	
5.	Industry needs	Rendering services in the fields related to Metallurgical Engineering following professional and ethical practices.	
6.	Society	Following professional and ethical practices.	

Programme Educational Objectives (PEOs):

1. To establish a student's organization in active mode to arrange various events in the department.
2. To sign MOU with the IIM and ASM to arrange various activities in the department for the benefit of the students.
3. To identify areas to start new businesses in the field of Metallurgy.

Program Outcomes:

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 analyze 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 analyze individual needs and engage in updating in the context of technological changes.

Programme Specific Outcomes (PSO's):

1. To prepare the students to play the role of metallurgist in industries.
2. To create awareness about safety protocols to be followed in various metallurgical industries.
3. Develop sensitivity among the students about the environmental hazards caused due to the pollutants generated in metallurgical industries.

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

Overview of Curriculum MPECS-2023

Total No. of Credits		120
No. of courses offered	Total	41
	Theory	29
Max. no. courses in a semester		07
Total Maximum Marks		5100
Diploma Awarded Marks (5^{th} & 6^{th} semester)		1700
Total Credit for Every Semester		20
Notional Learning Hours		40
% Ratio of Th: Pr	Marks -Wise	56:44
	Hour-wise	60:40
Elective Courses		
Optional Courses	No. of courses	02
	Options/course	1/3
No. of Practical/Oral Examination	Internal	12
	External	09

Diploma shall be awarded on the basis of marks obtained in fifth and sixth semester courses.

Salient Features of Curriculum MPECS-2023

The curriculum is outcome based and has been reinforced with some new courses while obsolete contents of courses have been replaced with the state of art contents.

Addition and deletion of Courses with respect to MPECS-2023:

1. In MPECS 2023, Total Credit = 120 and Total marks=5100 whereas the diploma award marks=1700 Marks.
2. Addition of courses basic metallurgy, corrosion and surface protection and Robotics, IoT and 3-D Printing. Removal of Furnaces, Refractories & Pyrometry course.
3. In MPECS 2023, Internship of 16 weeks introduced in fifth semester (Credit =10).
4. Indian Knowledge System (IKS) is added in the curricula of some courses. Also, Self learning activities are also added in some courses.
5. Social life skill course introduced in second semester as self- learning activity.
6. Due to internship of 16 weeks, some of the courses are shifted.
7. New courses like basic metallurgy, corrosion and surface protection are added.
8. The online examination course - Environmental Education and Sustainability has been included in the fourth semester of MPECS2023.

Major modifications in Course Contents with respect to MPECS-2023:

1. Iron and steel making course split into two courses i.e. Iron making and Steel Making.
2. In the course Metal joining and special forming processes, special forming process.

Changes in Implementation Strategy and Treatment with respect to MPECS-2020:

In MPECS 2023, Assessment weightage is given to self-learning activity.

The assessment of Internship is done in the fifth semester.

Other salient features:

1. 16 week Internship is offered in fifth semester.
2. MSBTE has sponsored two Centre of Excellence such as Robotics Automation lab and IoT lab. In that context we have offered Robotics, IoT and 3-D Printing course to the third year students.

4. PATH WISE CURRICULUM STRUCTURE

PATH1- STUDENTS ADMITTED TO FIRST YEAR – X STD. PASS OUT

LEARNING SCHEME AND ASSESSMENT SCHEME

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	: MT	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: First	Scheme	: H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work +Assignment)	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 PHYSICS	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 GRAPHICS	HGRB	DSC	1	CCH106	2	2	--	4	--	6	3	4	30	70	100	40	50	20	--	--	--	--	150
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	METALLURGICAL WORKSHOP PRACTICEⱧ	HWMT-I	SEC	1	MTH101	2	--	--	4	--	4	2	--	--	--	--	--	25	10	50@	20	--	--	75
6	FUNDAMENTALS OFICT	HICT	SEC	2	CCH202	--	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						17	15	2	15	8	40	20		120	280	400		175		125		125		825

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

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./Apprenti./Project./Community (INP) : 0,Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	: MT	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: Second	Scheme	: H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work +Assignment)	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	APPLIED MATHEMATICS	HAMT	AEC	3	CCH113	2	4	2	--	--	6	3	3	30	70	100	40	--	--	--	--	--	--	100
2	ENGINEERING CHEMISTRY	HCHB	DSC	1	CCH104	4	4	--	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25 @	10	25	10	175
3	COMMUNICATION SKILLS	HCMS	AEC	2	CCH201	--	4	--	2	2	8	4	3	30	70	100	40	25	10	--	--	25	10	150
4	SOCIAL & LIFE SKILLS	HSLS	VEC	2	CCH204	--	--	--	1	1	2	1	--	--	--	--	--	25	10	--	--	25	10	50
5	ENGINEERING DRAWING	HEDR	AEC	1	CCH110	4	2	--	4	2	8	4	4	30	70	100	40	25	10	25	10	25	10	175
6	BASIC METALLURGY	HBME	DSE	3	MTH301	2	3	--	1	--	4	2	3	30	70	100	40	25	10	--	--	--	--	125
7	METALLURGICAL WORKSHOP PRACTICE – II	HWMT -II	SEC	1	MTH102	2	--	--	4	--	4	2	--	--	--	--	--	25	10	50 @	20	--	--	75
Total						14	17	2	14	7	40	20		150	350	500		150		100		100		850

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	: MT	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: Third	Scheme	: H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work +Assignment)	Notional Learning Hrs/Week		Paper Duration (hrs.)	Theory				Based on LL & TL Practical				Based on Self Learning		Total Marks
							CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
1	Metallurgical Thermodynamics	HMTH	DSC	3	MTH302	2	3	1	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
2	Metallurgical Analysis	HMA	DSC	3	MTH303	2	3	--	2	1	6	3	3	30	70	100	40	25	10	--	--	25	10	150
3	Foundry Technology - I	HFT-I	DSC	3	MTH304	2	3	--	2	1	6	3	3	30	70	100	40	--	--	25@	10	25	10	150
4	Physical Metallurgy-I	HPHM-I	DSC	3	MTH305	2	3	--	2	1	6	3	3	30	70	100	40	--	--	25@	10	25	10	150
5	Iron Making	HIM	DSC	3	MTH306	2	4	--	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
6	Mechanical Engineering	HME	DSC	3	MTH307	--	3	--	2	1	6	3	3	30	70	100	40	--	--	--	--	25	10	125
7	Auto CAD & 3-D Modelling	HATM	DSC	3	MTH308	--	1	--	4	1	6	3	--	--	--	--	--	--	--	50	20	25	10	75
8	Essence of Indian Constitution	HEIC	VEC	3	CCH307	--	1	--	--	1	2	1	--	--	--	--	--	--	--	--	--	50	20	50
Total							21	1	12	6	40	20				600		25		100		175		900

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code : MT | With Effect From Academic Year : 2023-24

Duration Of Programme : 6 Semester | Duration : 16 WEEKS

Semester : Fourth | Scheme : H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work +Assignment)	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	Testing of Materials	HTM	DSC	3	MTH309	2	4	--	2	2	8	4	3	30	70	100	40	--	--	25@	10	25	10	150
2	Steel Making	HSM	DSC	3	MTH310	2	4	--	--	2	6	3	3	30	70	100	40	--	--	--	--	25	10	125
3	Physical Metallurgy-II	HPHM-II	DSC	3	MTH312	--	4	--	2	2	8	4	3	30	70	100	40	--	--	25#	10	25	10	150
4	Foundry Technology-II	HFT- II	DSC	3	MTH313	--	4	--	2	2	8	4	3	30	70	100	40	--	--	25#	10	25	10	150
5	Electrical & Electronics Engg.	HEEE	AEC	3	MTH311	--	4	--	2	--	6	3	3	30	70	100	40	25	10	--	--	--	--	125
6	Environmental Edu. & Sustainability	HEES	VEC	2	CCH206	2	2	--	--	2	4	2	1.5	30	70*#	100	40	--	--	--	--	25	10	125
Total						10	22		08	10	40	20				600		25		75		125		825

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	: MT	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: Fifth	Scheme	: H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Cr	Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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	Internship (16 Weeks	HINT	INP	5	CCH505	--	16 weeks Industrial Training				--	10	10	--	--	--	--	--	100	40	100#	40	--	--	200
Duration – 8 Week (Online - 28 July 2025 to 19 September 2025)																									
2	Project	HPRJ	INP	5	MTH501	--	--	--	4	2	6	1.6	2	--	--	--	--				50#	20	50	20	100
3	Entreprenurship & Startup	HESU	SEC	5	CCH501	1	2	--	--	1	3	0.8	1	--	--	--	--	--	--	--	--	--	50	20	50
4	Elective – (Management Courses)	--	AEC	5	CCH502/ 503/ 504	-	5	-	-	1	6	1.6	2	1	15*#	35*#	50	20	--	--	--	--	50	20	100
Duration – 6 Week (Offline - 22 September 2025 to 01 November 2025)																									
5	Metal Working Processes	HMWP	DSC	4	MTH401	2	6	--	4	2	12	2.4	2	3	30	70	100	40	--	--	25#	10	25	10	150
6	Corrosion & Surface Protection	HCSP	DSC	4	MTH402	--	8	--	2	2	12	2.4	2	3	30	70	100	40	--	--	25#	10	25	10	150
7	Robotics, IoT & 3-D Printing	HRTP	SEC	4	MTH403	--	--	--	4	--	4	0.8	1	--	--	--	--	--	50	20	--	--	--	--	50
Total						3	21	--	14	8	43		20		75	175	250		150		200		200		800

ELECTIVE-I COURSES

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	
ELECTIVE-I																									
1.	Industrial Organization and Management	HIOM	AEC	5	CCH502		5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100
2.	Marketing Management	HMKM	AEC	5	CCH503		5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100
3.	Project Management	HPRM	AEC	5	CCH504		5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code : MT | With Effect From Academic Year : 2023-24

Duration Of Programme : 6 Semester | Duration : 16 WEEKS

Semester : Sixth | Scheme : H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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	Failure Analysis and Selection of Materials	HFASM	DSC	4	MTH404	--	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	50	20	200
2	Powder Metallurgy	HPM	DSC	4	MTH405	--	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	Metal Joining	HMJ	DSC	4	MTH406	2	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4	Extraction of Non-Ferrous Metals	HENFM	DSC	4	MTH407	--	4	--	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
5	Elective – Metallurgy Courses		DSE	5	MTH502/503/504	--	4	--	2	--	6	3	3	30	70	100	40	50	20	--	--	--	--	150
6	Casting Simulation	HCS	SEC	5	MTH505	--	2	--	4	--	6	3	--	--	--	--	--	50	20	50@	20	--	--	100
Total						02	22	--	12	6	40	20				500		175		125		100		900

ELECTIVE-II COURSES (Departed related Courses)

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.	Environment Protection in Metallurgical Industries	HEPMI	DSE	4	MTH502	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150
2.	Non Metallic Materials	HNMM	DSE	4	MTH503	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150
3.	Advanced Physical Metallurgy	HAPM	DSE	4	MTH504	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150

PATH 2- STUDENTS ADMITTED DIRECTLY TO SECOND YEAR
EARNING SCHEME AND ASSESSMENT SCHEME

Government Polytechnic Kolhapur																									
Learning and Assessment Scheme for Post S.S.C Diploma Courses																									
Diploma In Metallurgical Engineering																									
Programme Code : MT											With Effect From Academic Year : 2023-24														
Duration Of Programme : 6 Semester											Duration : 16 WEEKS														
Semester : Third											Scheme : H														
Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme													
							Actual Contact Hrs./Week			Self Learning (Term Work +Assignment)	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	Metallurgical Thermodynamics	HMTH	DSC	3	MTH302	2	3	1	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
2	Metallurgical Analysis	HMA	DSC	3	MTH303	2	3	--	2	1	6	3	3	30	70	100	40	25	10	--	--	25	10	150
3	Foundry Technology - I	HFT-I	DSC	3	MTH304	2	3	--	2	1	6	3	3	30	70	100	40	--	--	25@	10	25	10	150
4	Physical Metallurgy-I	HPHM-I	DSC	3	MTH305	2	3	--	2	1	6	3	3	30	70	100	40	--	--	25@	10	25	10	150
5	Iron Making	HIM	DSC	3	MTH306	2	4	--	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
6	Mechanical Engineering	HME	DSC	3	MTH307	--	3	--	2	1	6	3	3	30	70	100	40	--	--	--	--	25	10	125
7	Auto CAD & 3-D Modelling	HATM	DSC	3	MTH308	--	1	--	4	1	6	3	--	--	--	--	--	--	--	50	20	25	10	75
8	Essence of Indian Constitution	HEIC	VEC	3	CCH307	--	1	--	--	1	2	1	--	--	--	--	--	--	--	--	--	50	20	50
Total							21	1	12	6	40	20				600		25		100		175		900

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	: MT	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: Fourth	Scheme	: H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work +Assignment)	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	Testing of Materials	HTM	DSC	3	MTH309	2	4	--	2	2	8	4	3	30	70	100	40	--	--	25@	10	25	10	150
2	Steel Making	HSM	DSC	3	MTH310	2	4	--	--	2	6	3	3	30	70	100	40	--	--	--	--	25	10	125
3	Physical Metallurgy-II	HPHM-II	DSC	3	MTH312	--	4	--	2	2	8	4	3	30	70	100	40	--	--	25#	10	25	10	150
4	Foundry Technology-II	HFT- II	DSC	3	MTH313	--	4	--	2	2	8	4	3	30	70	100	40	--	--	25#	10	25	10	150
5	Electrical & Electronics Engg.	HEEE	AEC	3	MTH311	--	4	--	2	--	6	3	3	30	70	100	40	25	10	--	--	--	--	125
6	Environmental Edu. & Sustainability	HEES	VEC	2	CCH206	2	2	--	--	2	4	2	1.5	30	70*#	100	40	--	--	--	--	25	10	125
Total						10	22		08	10	40	20				600		25		75		125		825

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	: MT	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: Fifth	Scheme	: H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Cr	Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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	Internship (16 Weeks	HINT	INP	5	CCH505	--	16 weeks Industrial Training				--	10	10	--	--	--	--	--	100	40	100#	40	--	--	200
Duration – 8 Week (Online - 28 July 2025 to 19 September 2025)																									
2	Project	HPRJ	INP	5	MTH501	--	--	--	4	2	6	1.6	2	--	--	--	--				50#	20	50	20	100
3	Entreprenurship & Startup	HESU	SEC	5	CCH501	1	2	--	--	1	3	0.8	1	--	--	--	--	--	--	--	--	--	50	20	50
4	Elective – (Management Courses)	--	AEC	5	CCH502/ 503/ 504	-	5	-	-	1	6	1.6	2	1	15*#	35*#	50	20	--	--	--	--	50	20	100
Duration – 6 Week (Offline - 22 September 2025 to 01 November 2025)																									
5	Metal Working Processes	HMWP	DSC	4	MTH401	2	6	--	4	2	12	2.4	2	3	30	70	100	40	--	--	25#	10	25	10	150
6	Corrosion & Surface Protection	HCSP	DSC	4	MTH402	--	8	--	2	2	12	2.4	2	3	30	70	100	40	--	--	25#	10	25	10	150
7	Robotics, IoT & 3-D Printing	HRTP	SEC	4	MTH403	--	--	--	4	--	4	0.8	1	--	--	--	--	--	50	20	--	--	--	--	50
Total						3	21	--	14	8	43		20		75	175	250		150		200		200		800

ELECTIVE-I COURSES

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	
ELECTIVE-I																									
1.	Industrial Organization and Management	HIOM	AEC	5	CCH502		5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100
2.	Marketing Management	HMKM	AEC	5	CCH503		5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100
3.	Project Management	HPRM	AEC	5	CCH504		5			1	6	1.6	2	1	15*#	35*#	50	20					50	20	100

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code : MT | With Effect From Academic Year : 2023-24

Duration Of Programme : 6 Semester | Duration : 16 WEEKS

Semester : Sixth | Scheme : H

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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	Failure Analysis and Selection of Materials	HFASM	DSC	4	MTH404	--	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	50	20	200
2	Powder Metallurgy	HPM	DSC	4	MTH405	--	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	Metal Joining	HMJ	DSC	4	MTH406	2	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4	Extraction of Non-Ferrous Metals	HENFM	DSC	4	MTH407	--	4	--	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
5	Elective – Metallurgy Courses		DSE	5	MTH502/503/504	--	4	--	2	--	6	3	3	30	70	100	40	50	20	--	--	--	--	150
6	Casting Simulation	HCS	SEC	5	MTH505	--	2	--	4	--	6	3	--	--	--	--	--	50	20	50@	20	--	--	100
Total						02	22	--	12	6	40	20				500		175		125		100		900

ELECTIVE-II COURSES (Departed related Courses)

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)	National 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.	Environment Protection in Metallurgical Industries	HEPMI	DSE	4	MTH502	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150
2.	Non Metallic Materials	HNMM	DSE	4	MTH503	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150
3.	Advanced Physical Metallurgy	HAPM	DSE	4	MTH504	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150

EXEMPTIONS FOR COURSES

Eligibility for Exemptions for First and Second Semester Courses of MPECS-2023 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
1	Engineering Physics	CCH101	**YES**	**YES**	No	No	No
2	Basic Mathematics	CCH105	**YES**	**YES**	No	**YES**	No
3	Applied Mathematics	CCH301	**YES**	**YES**	No	**YES**	No
4	FUNDAMENTALS OF ICT	CCH202	Yes,if MSCIT course completed by candidate before registration.				

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.

COURSE EQUIVALENCE FOR PREVIOUS MPECS

	MPEC 2016		MPEC2020		MPEC2023	
Sr. No	**Course Code**	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
1	CCF101	Engineering Physics	CCG101	Engineering Physics	CCH102	Engineering Physics
2	CCF103	Engineering Chemistry	CCG103	Engineering Chemistry	CCH104	Engineering Chemistry
3	CCF105	Basic Mathematics	CCG105	Basic Mathematics	CCH105	Basic Mathematics
4	CCF106	Engineering Mathematics	CCG106	Engineering Mathematics	CCH301	Applied Mathematics
5	CCF107	Engineering Drawing-I	CCG107	Engineering Drawing-I	CCH106	Engineering Graphics
6	CCF108	Engineering drawing-II	CCG108	Engineering drawing-II	CCH110	Engineering Drawing
7	CCF110	Applied Mechanics	CCG110	Applied Mechanics	CCH108	Applied Mechanics
8	CCF112	Workshop Practice I	CCG112	Workshop Practice I	MTH101	Metallurgical Workshop Practice- I
9	CCF116	Workshop Practice II	CCG116	Workshop Practice II	MTH102	Metallurgical Workshop Practice – II
10	----	----	CCG117	Sports and yoga	CCH203	Yoga And Meditation
11	CCF117	Computer Fundamentals	CCG201	Introduction to IT system	CCH202	Fundamentals Of ICT
12	CCF201	Generic Skills	----	----	----	----
13	CCF202	Communication Skills	CCG203	Communication Skills in English	CCH201	Communication Skills
14	----	----	----	----	CCH204	Social & Life Skills
15	----	----	CCG204	Environmental science	CCH206	Environmental Edu. & Sustainability
16	----	----	CCG205	Essence of Indian Traditional Knowledge	----	----
17	----	----	CCG206	Indian Constitution	CCH205	Essence of Indian Constitution
18	MTF 203	Professional Practices	MTG 203	Professional Practices	----	----
19	----	----	----	----	MTH301	Basic Metallurgy
20	MTF 301	Metallurgical Thermodynamics	MTG 301	Metallurgical Thermodynamics	MTH302	Metallurgical Thermodynamics
21	MTF302	Material Testing	MTG302	Material Testing	MTH309	Testing of Materials
22	MTF303	Metallurgical Analysis	MTG303	Metallurgical Analysis	MTH303	Metallurgical Analysis
23	MTF304	Extractive Metallurgy	MTG304	Iron and Steel Making	MTH306 MTH310	Iron Making Steel Making
24	MTF305	Foundry Technology. I	MTG305	Foundry Technology. I	MTH304	Foundry Technology - I
25	MTF306	Electrical Engineering and Electronics	MTG306	Electrical Engineering and Electronics	MTH311	Electrical & Electronics Engg.

26	MTF307	Physical Metallurgy I	MTG307	Physical Metallurgy I	MTH305	Physical Metallurgy-I
27	MTF308	Mechanical Engineering	MTG308	Mechanical Engineering	MTH307	Mechanical Engineering
28	MTF309	Furnaces, Refractories & Pyrometry	MTG309	Furnaces, Refractories & Pyrometry	----	----
29	MTF310	Metal working processes	MTG310	Metal working processes	MTH401	Metal Working Processes
30	MTF311	Seminar	MTG311	Seminar	----	----
31	MTF304	Extractive Metallurgy	MTG312	Extraction of Non Ferrous Metals	MTH407	Extraction of Non-Ferrous Metals
32	MTF501	3-D Modeling and Casting Simulation	MTG313	3-D Modeling	MTH308	Auto CAD & 3-D Modelling
33	MTF401	Physical Metallurgy II	MTG401	Physical Metallurgy II	MTH312	Physical Metallurgy - II
34	MTF402	Foundry Technology II	MTG402	Foundry Technology II	MTH313	Foundry Technology - II
35	MTF410	Corrosion and Protection Methods	----	----	MTH402	Corrosion & Surface Protection
36	----	----	----	----	MTH403	Robotics, IoT & 3-D Printing
37	MTF403	Failure Analysis & selection of Materials	MTG403	Failure Analysis & selection of Materials	MTH404	Failure Analysis & Selection of Materials
38	MTF404	Powder metallurgy	MTG404	Powder metallurgy	MTH405	Powder Metallurgy
39	MTF405	Project	MTG405	Project	MTH501	Project
40	MTF 406	Metal joining and Special forming processes	MTG 406	Metal joining and Special forming processes	MTH406	Metal Joining
41	MTF 407	In –plant training	MTG 407	In –plant training	CCH505	Internship (16 Weeks)
42	----	----	CCG501	Entrepreneurship and startup	CCH501	Entreprenurship & Startup
43	MTF501	3-D Modeling and Casting Simulation	MTG507	Casting Simulation	MTH505	Casting Simulation
44	MTF 502	Environment protection in metallurgical industries	MTG 502	Environment protection in metallurgical industries	MTH502	Environment protection in metallurgical industries
45	CCF501	Industrial Organization and Management	MTG 508	Industrial Organization and Management	CCH502	Industrial Organization and Management

Equivalence to the courses (and hence exemptions) of other programmes to be granted to branch change candidates entering the Diploma in Metallurgical Engineering programme will be decided by the Programme Dean in consultation with the teaching staff of the Metallurgical Engineering Department.

PROFORMA FOR
FORMATIVE ASSESSMENT OF PRACTICAL'S /TUTORIAL /SELF LEARNING ASSESSMENT AND SUMMATIVE ASSESSMENT PRACTICAL /ORAL EXAMINATION

Government Polytechnic Kolhapur

PROFORMA -I

Formative Assessment of Practical's /Tutorial /Self Learning Assessment

														Total Marks out of ( )	Marks converted As per scheme ( )
PR/TU/Assignment No.		1	2	3	4	5	6	7	8	9	10	11	12		
Sr.No.	Roll No.														
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

Government Polytechnic Kolhapur
PROFORMA II
Summative Assessment Practical /Oral Examination

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		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

SECTION-II
CURRICULM

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	**: MT**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: First**	**Scheme**	**: H**

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme											
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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 PHYSICS	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 GRAPHICS	HGRB	DSC	1	CCH106	2	2	--	4	--	6	3	4	30	70	100	40	50	20	--	--	--	--	150
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	METALLURGICAL WORKSHOP PRACTICE- I	HWMT-I	SEC	1	MTH101	2	--	--	4	--	4	2	--	--	--	--	--	25	10	50@	20	--	--	75
6	FUNDAMENTALS OF ICT	HICT	SEC	2	CCH202	--	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						17	15	2	15	8	40	20		120	280	400		175		125		125		825

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

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

COURSE ID :

COURSE NAME **:BASIC MATHEMATICS(CE/ME/ET/IT/EE/MT)**
COURSE CODE **: CCH105**
COURSE ABBREVIATION **: HBMT**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	4
	Tutorial Learning	02	
	LaboratoryLearning	-	
	SLH-SelfLearning	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-ClassRoomLearning,TL-TutorialLearning,LL-LaboratoryLearning,SLH-SelfLearningHours,NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self LearningAssessment

Legends:@InternalAssessment,#ExternalAssessment,*#OnLine Examination,@$InternalOnlineExamination(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.*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**	**PSO2**
Competency: Use DC machines and transformers.	3	2	1	-	1	-	2		
CCH105-1-CO-1 : To Apply concepts of algebra to solve engineering related problems	3	1	-	-	-	-	1		
CCH105-2-CO-2 : To Use techniques and methods of statistics to compare multiple sets of data	3	1	-	-	1	-	1		
CCH105-3-CO-3 : Solve area specific engineering problems under given conditions of straight lines	3	-	-	-	-	-	1		
CCH105-4-CO-4:- To memorize trigonometric formulae and solve problems based on them.	3	1	1	-	-	-	1		
CCH105-5-CO-5:- To solve the problems of maxima, minima, radius of curvature and geometrical applications.	3	2	1	-	1	-	1		

F. CONTENT:

I) Tutorial exercises

Solve any **TEN** 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 Standared Deviation aboutmean 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 others 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	02
2	Prepare a model using the concept of tangent and normal, bending of curves in case of sliding of a vehicle.	02
3	Prepare charts of grouped and ungrouped data.	02
4	Collect statistical data on real world problems and find Mean Deviation & S.D.	02
5	Collect at least 10 examples based on real world applications which will be used to find S.D. /Variance.	02
6	Prepare models to explain different concepts.	02
7	Prepare a model using concept of radius of curvature of bending of railway tracks.	02
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.	02
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.	02
10	Design a puzzle based on matrices . Create a grid of numbers and operations.	02
11	Develop a math game based on operations of matrices.	02

12	Collect examples based on real world applications of logarithm and prepare a pdf file.	02
13	Measure height of trees/buildings in surrounding locations using trigonometry and prepare presentation.	02
14	Apply trigonometric principles to calculate angles ,distances, dimensions relevant to the chosen area and make a poster presentation.	02
15	Find height of room or distance between two pillars by using concept of straight line.	02

****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:

Domain	**Particulars**	**Marks out of 25**
Cognitive	Understanding	05
	Application	05
Psychomotor	Solving skill	05
	Remembering formulae & Accuracy	05
Affective	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 internate.
5. Whatsapp groups.
6. Use of books

K) Teaching and Learning resources:

Chalk board, Books,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
	Sansar ke Mahan	Gunakar Muley	Raj kamal Prakashan ISBN-13.

13	Ganitagya		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

a. www.nptel.ac.in/courses/106102064/1
b. www.scilab.org/-SCI Lab
c. www.mathworks.com/product/matlab/-MATLAB
d. Spreadsheet Applications
e. http://ocw.abu.edu.ng/courses/mathematics/
f. https://ocw.mit.edu/
g. https://libguides.cmich.edu/OER/mathematics
h. https://libguides.furman.edu/oer/subject/mathematics

***

COURSE ID :
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	-	
	LaboratoryLearning	02	
	SLH-SelfLearning	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

(TotalIKSHrsforSem.: 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,#ExternalAssessment,*#OnlineExamination,@$InternalOnline Examination

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidateisnotsecuringminimumpassing marksinFA-PRofanycourse thenthecandidateshallbedeclared as"Detained"in that semester.
3. IfcandidateisnotsecuringminimumpassingmarksinSLAofanycoursethenthecandidateshallbedeclaredasfailand will have to repeat andresubmit SLAwork.
4. NotionalLearninghoursforthesemesterare(CL+LL+TL+SL)hrs.*15Weeks
5. 1(one)creditisequivalentto30Notionalhrs.
6. *Selflearning hoursshall notbe reflectedin theTimeTable.

*Selflearningincludesmicroproject/assignment/otheractivities.(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/EMPLOYEREXPECTEDOUTCOME

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. COURSELEVELLEARNINGOUTCOMES(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**	**PSO1**	**PSO2**
CCH102-1 Estimate errors in measurement of physical quantities.	3	1	-	1	1	1	1		
CCH102-2 Express importance of semiconductors and nanotechnology	3	-	-	-	1	1	1		
CCH102-3 Select proper material in engineering industry by analysis of its physical properties	3	1	-	1	1	1	1		
CCH102-4 Apply principles of electricity and magnetism to solve engineering problems	3	1	-	1	1	1	1		
CCH102-5Apply principles of optics to solve engineering problems.	3	1	-	-	1	1	1		
CCH102-6Apply principles of acoustics and ultrasonics for related engineering applications.	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	CO
1	To measure internal and external dimensions of hollow cylinder by using Vernier Caliper	CCH102-1
2	To measure the diameter of bob and thickness of plate by using Vernier Caliper	CCH102-1
3	To measure the diameter of bob and thickness of plate by using Micrometer screw gauge	CCH102-1
4	To determine forbidden energy band gap in semiconductors	CCH102-2
5	To determine the viscosity of liquid by Stokes method.	CCH102-3
6	To determine the buoyancy force on a solid immersed in a liquid	CCH102-3
7	To measure unknown resistance of wire by Ohm's law	CCH102-4

Sr. no	Laboratory experiences	CO
8	To verify series law of resistances	CCH102-4
9	To verify parallel law of resistances	CCH102-4
10	To draw magnetic lines of force for given magnet by using magnetic compass	CCH102-4
11	To verify Snell's law using glass slab	CCH102-5
12	To study variation of δ with i for a prism by pin method	CCH102-5
13	To determine velocity of sound by resonance tube	CCH102-6
14	To measure distance using ultrasonic meter	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
CO: 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 **SimpleNumerical problems**	**10**	**12**
CO: CCH102-2Express 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**	**08** (06)	**08** (06)

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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**	(02)	(02)
CO: CCH102-3Select 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 Modulusof 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 **SimpleNumerical 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 ofliquids 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
CO: CCH102-4 Apply principles of electricity and magnetism to solve engineering problems			
4	**ELECTRICITY AND MAGNETISM** **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 4.1.7 **SimpleNumerical problems** **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**	**10** (06) (04)	**12** (08) (04)
CO: CCH102-5 Apply principles of optics to solve engineering problems			
5	**OPTICS** **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) 5.1.5 **SimpleNumerical problems** **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** **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**	**14** (06) (04) (04)	**18** (08) (06) (04)

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH102-6Apply 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 (eg. sugar, salt etc) and list the physical/elerical/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	Wrie the information of factors to be considered while planning of an auditorium. (For CE/ME/MT students).	02
	AND	
Sr.No	List of Activity (any one of the following 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/ 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**	**Marksallotted**
1	Attendanceatregularpractical	05
2	Preparednessforpractical	05
3	Neat& completeDiagram / 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	Marksallotted
1	Attendance	05
2	Preparednessand 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	SteeramulaRajeswara 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

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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:

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	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 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
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.	2	CO1
2	Draw different types of lines, dimensioning styles	2	CO1
3	Draw one figure showing dimensioning techniques, two problems on redraw the figures. (Sketch Book)	2	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)	2	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)	2	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.	2	CO5
12	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs etc. (Sketchbook)	2	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)	2	CO5
14	Draw different types of sections of simple objects (Sketchbook)	2	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)	2	CO1 CO2 CO3 CO4 CO5 CO6

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 Arc's 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 -First and Third angle Projection Method, their symbols 5.2 Conversion of Pictorial view into Orthographic Views. (First angle Projection Method Only)	**05**	**14**
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. http://www.design-technology.info/IndProd/drawings/
2. http://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/
3. http://en.wikipedia.org/wiki/Engineering_drawing
4. http://www.engineeringdrawing.org/
5. http://www.teachengineering.org/view_activity
6. www.howtoread.co.in/2013/06/how-to-read-ed.html
7. http://www.slideshare.net/akhilrocker143/edp
8. http://www.24framesdigital.com/pstulpule

*** * ***

COURSE ID :

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						
03	**FA-TH**	**SA-TH**	**TOTAL**		**FA -PR**		**SA-PR**		**MAX**	**MIN**	**175**
	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 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.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 forms 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.

Competency identified for the course:.

The MPEC 2020 curriculum design based on MSBTE K curriculum guideline and NEP2020 policy incorporates all salient features such as notional hours and non-national hours of learning. Indian knowledge system through 2 hours in a semester is aimed at exploring ancient traditional technical knowledge prevailing in the country. Subject is given 4 hrs. Of class room learning, 2hrs of practicals (lab learning) and 2 hrs. of self-leaning. All these hrs. Of learnings including IKS learning are aimed at achieving following skills sets.

Cognitive	Psychomotor	Affective domain
Understanding force concepts in various mechanics through FBD for various physical situations Solving for equilibrium condition of various force system and appreciating the mechanism analytically. Understanding the kinematics geometry of motion in rectilinear and circular motion Solving static equilibrium and dynamic equilibrium condition(kinetics) and lifting machines. Formative assessment is employed through two unit test., end semester exam (specification table) (30 marks)and progressive assessment format for lab work is to be followed .(10 marks)	Practicals with hands on experience on force system to verify Lamis theorem ,law of polygon of forces ,parallelogram of forces ,beam reactions on force table or similar set up. Lifting machines are operated to establish law of machine and compute efficiency . By performing motion of bodies with different surfaces in contact , frictional resistance is evaluated . By simulating areas to forces centroid for different laminae is graphically found. progressive assessment format for lab work is to be followed(10marks) .	All practical systematically executed to understand the principles, appreciate the inferences with the set of observations conducting lab learning in a small group where every individual gets ample opportunity, essence of team work is developed, result oriented performance is appreciated and time bound activity is scheduled . the neatness and presentation skills are appreciated in formative progressive assessment format for lab work is to be followed (5marks).

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	**PSO1**	**PSO2**
Competency: Applied Mechanics	3	2	2	2	3	1	2		
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.	3	2	-	2	-	1	2		
CCH108-2 Study of equilibrium for concurrent and non-concurrent force system and finding resultant and equilibrant graphically and analytically.	3	2	1	2	-	1	2		
CCH108-3 Problems on equilibrium condition involving friction and support	3	2	1	2	-	1	2		

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**	**PSO2**
reactions in beams graphically and analytically.									
CCH108-4 Knowing simple lifting mechanisms establishing law of machine, evaluating efficiency for set of loads.	3	2	1	3	2	1	2		
CCH108-5 Studying equations of motion for rectilinear and circular motion, establishing relation between linear and angular motion parameters.	2	1	1	2	-	1	2		
CCH108-6 Understanding effect of force for executing work, energy principles and conservation of energy concept.	2	2	1	2	-	1	2		

Note : typical matrix assessment based on previous records—for continuous analysis improvement .

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 hours	12 marks
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 hours	12 marks
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 hours	10 marks
	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.	12 hours	14 marks

	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		
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 hours	12 marks
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 hours	10 marks
	Total	**30**	**36**

G. List of Assignments/Microprojects under SLA

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

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		

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 :
COURSE NAME : Metallurgical Workshop Practice - I
COURSE CODE : MTH101
COURSE ABBREVIATION : HWMT-I

A. LEARNING SCHEME:

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

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Pracctical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
--	--	--	--	--	25	10	50@	20	--	--	75

(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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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 course is mainly deals with Forging, Moulding and Turning operation. These processes are commonly used in Engineering Industry. A technician has to work in such 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

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

1. Demonstrate various forging, moulding and turning operations.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MTH101-1 Select different types of tools required for forging, moulding and turning operations.
MTH101-2 Select a precise forging operation for a given job.
MTH101-3 Prepare a job with forging, moulding and turning operations.
MTH101-4 Practicing safety in workshop.

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"

		Programme Outcomes POs and PSOs								
Competency and Cos	**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** To prepare the students to play the role of metallurgist in industries	**PSO2** To create awareness about safety protocols to be followed in various metallurgical industries	**PSO3** Develop sensitivity among the students about the environmental hazards caused due to the pollutants generated in metallurgical industries.
CO-1 Select different types of	3	2	2	2	2	2	3	3	2	2

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** To prepare the students to play the role of metallurgist in industries	**PSO2** To create awareness about safety protocols to be followed in various metallurgical industries	**PSO3** Develop sensitivity among the students about the environmental hazards caused due to the pollutants generated in metallurgical industries.
tools required for forging, moulding and turning operations										
CO-2 Select a precise forging operation for a given job	3	2	2	2	2	2	3	2	2	2
CO-3 Prepare a job with forging, moulding and turning operations.	3	1	3	2	2	3	3	3	2	2
CO-4 Practicing safety in workshop	3	2	2	1	2	2	2	2	3	3

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 experiences	CO
1	**Smithy Shop :-** Demonstration of different forging tools.	1
2	Demonstration of different forging processes like shaping, fullering, setting down operations etc.	2
3	One job like hook, flat chisel or any hardware item Note - One job of standard size (saleable/marketable article per student)	2,4
4	**Moulding Shop** :- Illustration of various materials and equipments used in making mould.	1
5	Study of pattern making.	1
6	Demonstration of gating system in casting	3
7	To prepare a sand mold, using the pattern.	3,4
8	**Turning Shop** :- Demonstration of various tools used in turning shop.	1
9	Demonstration of turning operation using lathe machine.	3
10	Preparation of one simple job involving turning operation.	3,4

II) Theory - NA

G : List of Assignments under SLA
NA

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 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 50 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Knowledge about the course	10
2	Preparedness for practical /Oral	10
3	Neat & complete Diagram/write up	10
4	Observations/Handling of instrument/ Communication/Presentation	10
5	Oral Based on Lab work and completion of task	10
TOTAL		**50**

J) Instructional Methods:

1. Demonstration during practical.
2. Workshop Record Book.

K) Teaching and Learning resources:

1. Shop Demonstration.
2. Hands on training on machine.

L) Reference Books:

S.N.	Name of Book	Author	Publication
1	Elements of workshop Technology – Volume I & II	S. K. Hajra Chaudhary, Bose, Roy	Media Promoters and Publishers limited
2	Elements of workshop Technology – Volume I & II	B.S. Raghuvanshi	Dhanpat Rai & Co.

M) Learning Website & Software

1. http://nptel.ac.in
2. You Tube – Forging, Moulding, Turning.

***

COURSE ID: 06

Course Name : Fundamentals of ICT (CE/ME/EE/MT/ET/IT)

Course Code : CCH202

Course Abbreviation : HICT

1. TEACHING-LEARNING & ASSESSMENT SCHEME :

Scheme component	Hours / week	Credits
Theory	1	2
Practical	2	

Course Code	Course Title	Abbr	Course Category /s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TSL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
CCH202	FUNDAMENTALS OF ICT	ICT	SEC	1	-	2	1	4	2		-	-	-	-	25	10	25@	10	25	10	75

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learn Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - India 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 das 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.
7. * Self learning includes micro project / assignment / other activities.

♦ Candidate remaining absent in practical examination of any one part of Basic Science course i.e. Physics,Chemistry will be declare as Absent in Mark List and has to appear for examination. The marthe part for which candidate was present will not be processed or carried forward.

2. 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.

3. 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

4. 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

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

1	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**	**PSO- 2**
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: -
*PSOs are to be formulated at institute level

6. 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 of computer system 1.2 Work with Computer System, Input/output devices, and	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 WordProcessing.	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 inSpreadsheet.	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 givenpresentation 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	CCH202-4

		handouts/notes	
13	a) Insert Animation effects to Text and Slides. b) Insert Audio and Video files inpresentation	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

7. 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 informatUse Calendar to Schedule and edit activities. 3) Use Translate app to translate the given content from one langanother. 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 a its 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 students) 3) Prepare slides with all Presentation featur 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) C Survey on different web browsers. 6) Generate resume for different job profile, survey report of any industry ChatGPT/any other AI tool.

8. 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)

9. 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
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

Sr. No.	Topics / Sub-topics	Lectures (Hours)
Course Outcome CCG202-3: 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 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.	3
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	3

Sr. No.	Topics / Sub-topics	Lectures (Hours)
	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	

10. **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

11. PROGRESSIVE SKILLS TEST :

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.

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**

12.INSTRUCTIONAL STRATEGIES:

Instructional Methods:

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

Teaching and Learning resources:

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

13.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	CreatevSpace Independent Publishing Platform- 2016, ISBN-13: 978-1533683731
4	Johnson Steve	Microsoft Office 2010: On Demand	Pearson Education, New Delhi India, 2010. ISBN :9788131770641
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

b) Suggested Websites and Portals

Sr.No	Link / Portal	Description
1	https://www.microsoft.com/en-in/learning/office-training.aspx	Office
2	http://www.tutorialsforopenoffice.org/	Open Office
3	https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf	Open Office
4	https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf	Computer Fundamental
5	http://www.tutorialsforopenoffice.org/	Open Office
6	https://www.tutorialspoint.com/computer_fundamentals/index.htm	Computer Fundamental
7	https://www.tutorialspoint.com/word/	Word Processing
8	https://www.javatpoint.com/ms-word-tutorial	Word Processing

Sr.No	Link / Portal	Description
9	https://support.microsoft.com/en-au/office/word-for-windows-training-7bcd85e6-2c3d-4c3c-a2a5-5ed8847	Word Processing
10	https://www.javatpoint.com/excel-tutorial	Spreadsheet
11	https://support.microsoft.com/en-au/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb	Spreadsheet
12	https://www.javatpoint.com/powerpoint-tutorial	Powerpoint Presentation
13	https://support.microsoft.com/en-au/office/powerpoint-for-windows-training-40e8c930-cb0b-40d8-82c4-b	Powerpoint Presentation
14	https://www.geeksforgeeks.org/ms-dos-operating-system/	Operating System
15	https://www.javatpoint.com/windows	Windows Operating System
16	https://www.javatpoint.com/what-is-linux	Linux Operating System
17	https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT	IoT
18	https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/	IoT
19	https://www.javatpoint.com/machine-learning	AI & Machine Learning
20	https://www.skillrary.com/blogs/read/introduction-to-drone-technology	Drone Technology
21	https://www.cnet.com/tech/computing/what-is-3d-printing/	3D Printing
22	https://support.google.com/a/users/answer/9389764?hl=en	Apps

***

COURSE ID:
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	
	LaboratoryLearning	01	
	SLH-SelfLearning	01	
	NLH-Notional Learning	2	

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**	
-NA-	-NA--	--NA-	--NA-	-NA-	**25**	**10**	--NA-	--NA-	**25**	**10**	**50**

(Total IKS Hrs for Semester: 01Hr)

C: ABBREVIATIONS:- CL-Class-RoomLearning,TL-TutorialLearning,LL-LaboratoryLearning,SLH-SelfLearningHours,NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self LearningAssessment

Legends:@InternalAssessment,#ExternalAssessment,*#OnLine Examination,@$InternalOnlineExamination(TNR 12 font)

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidateisnotsecuringminimumpassing marksinFA-PRofanycourse thenthecandidateshallbedeclared as"Detained"in that semester.
3. IfcandidateisnotsecuringminimumpassingmarksinSLAofanycoursethenthecandidateshallbedeclaredasfailand will have to repeat andresubmit SLAwork.
4. NotionalLearninghoursforthesemesterare(CL+LL+TL+SL)hrs.*15Weeks
5. 1(one)creditisequivalentto30Notionalhrs.
6. *Selflearning hoursshall notbe reflectedin theTimeTable.

*Selflearningincludesmicroproject/assignment/otheractivities.(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 situationsin career as employee or as an entrepreneur. Yogaand Meditation brings about the holistic development of an individual and equips with necessary balance to handle the challenges. Theage of polytechnic student is appropriate to get introduced to yoga practice as this will help them in studies as well as his professionallife. Moreover, Yoga inculcates discipline in all walks of the life of student. Pranayama practice regulates breathing practices of thestudent 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-

- CCH110-1Practice basic Yoga and Pranayam in daily life to maintain physical and mental fitness.
- CCH110-2-Practice meditation regularly for improving concentration and better handling of stress and anxiety.
- CCH110-3-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)	ProgrammeOutcomes(POs)							**Programme**SpecificOutcomes*(PSOs)		
	PO-1BasicandDisciplineSpecificKnowledge	PO-2 ProblemAnalysis	PO-3 Design/DevelopmentofSolutions	PO-4 Engineering Tools	PO-5 EngineeringPracticesforSociety,SustainabilityandEnvironment	PO-6Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	
CO1	-	-	-	-	3	-	1	-	-	
CO2	-	-	-	-	3	-	1	-	-	
CO3	-	-	-	-	3	-	1	-	-	
Legends:-High:03,Medium:02,Low:01,NoMapping:- *PSOsaretobeformulatedatinstitute level										

F. CONTENT:

I) Practical exercises

Sr No	LaboratoryExperiment/PracticalTitles/TutorialTitles	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 totoeforYoga - i)Nack Movement ii)Shoulder Movement iii) Trunk Movement iv)Knee Movement v) Ankle Movement	03	CCH110-1
2	Lab Exp: 2. Afterwarmup, perform all the postures of Surya Namaskar one by one in averyslowpace, 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	CCH110-1,CCH110-2
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	CCH110-2
4	Lab Exp: 8 Perform Deepbrathing , Anulom Vilom Pranayam Kriya LabExp:9 Practice Kapalbhati Pranayam Kriya, Bhastrika LabExp:10 Practice Bhramary Pranayam and Sheetali Pranayam	2	CCH110-3
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	CCH110-3

II) Theory : (Not Applicable)

Section I NA

Section –II NA

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

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 andnutrition 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	15hrs

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

- Maintainadiaryindicatingdatewisepracticedone bythestudentwith aphotographofselfinyogicposture.Prepare Dietforandnutrition chartself

Assignment:

Prepare Diet for and nutrition chart for your self

- Self-**Learning**
  - Practiceatleast thrice aweek.
  - Read booksondifferentmethodstomaintainhealth,wellnessandtoenhancemood
  - WatchvideosonYogaPractices.

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

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks	CO
		Remember	Understand	Apply		
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	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**

ii) Summative Assessment of Practical: NA

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

Sr.no	**Criteria**	**Marksallotted**
NA	NA	NA
NA	NA	NA
NA	NA	NA
NA	NA	NA
NA	NA	NA
TOTAL		**NA**

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	SwamiVivekananda	Fingerprint Publishing (2023) Prakash BooksIndiaPvtLtd,NewDelhiI SBN-13?:?978-9354407017
2	Yoga for Every Body: A beginner's guide to the practice of yoga postures, breathing Exercises and me	LuisaRay,AngusSutherland	VitalLifeBooks (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	WatkinsPublishing(2019) ISBN-13?:?978-1786782786

4	The Relaxation and Stress Reduction Workbook	Martha Davis, ElizabethRobbins,MatthewMcKay, Eshelman MSW	ANewHarbingerSelf-HelpWorkbook(2019)
5	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	AnnSwanson	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/ncel9sc04/preview-Food Nutrition for Healthy Living Course —Swayam

6 https://onlinecourses.swayam2.ac.in/aic23 e06/ preview- yoga for memory development

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Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	**: MT**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Second**	**Scheme**	**: H**

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme											Total Marks
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	Notional Learning Hrs/Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		
																		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 CHEMISTRY	HCHB	DSC	1	CCH104	4	4	--	2	2	8	4	1.5	30*#	70*#	100	40	25	10	25@	10	25	10	175
3	COMMUNICATION SKILLS	HCMS	AEC	2	CCH201	--	4	--	2	2	8	4	3	30	70	100	40	25	10	--	--	25	10	150
4	SOCIAL & LIFE SKILLS	HSLS	VEC	2	CCH204	--	--	--	1	1	2	1	--	--	--	--	--	25	10	--	--	25	10	50
5	ENGINEERING DRAWING	HEDR	AEC	1	CCH110	4	2	--	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175
6	BASIC METALLURGY	HBME	DSE	3	MTH301	2	3	--	1	--	4	2	3	30	70	100	40	25	10	--	--	--	--	125
7	METALLURGICAL WORKSHOP PRACTICE – II	HWMT-II	SEC	1	MTH102	2	--	--	4	--	4	2	--	--	--	--	--	25	10	50@	20	--	--	75
Total						14	17	2	14	7	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

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./Apprenti./Project./Community (INP) : 0,Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE ID :
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	
	LaboratoryLearning	-	
	SLH-SelfLearning	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-ClassRoomLearning,TL-TutorialLearning,LL-LaboratoryLearning,SLH-SelfLearningHours,NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA -Self LearningAssessment

Legends:@InternalAssessment,#ExternalAssessment,*#OnLine Examination,@$InternalOnlineExamination(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.*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 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) Competency:

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.

1.Cognitive : Understanding and applying principles of mathematics to engineering problems
2. Psychomotor: To prepare charts displaying the area of irregular shapes using the concept of integration,prepare charts to displaying grouped and ungrouped data .
3. Affective : discipline, consistency, hard work , to concentrate ,accuracy, punctuality, aesthetics

E. COURSE LEVEL LEARNING OUTCOMES (COS)

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**	**PSO1**	**PSO2**
Competency: Use DC machines and transformers.	3	2	1		1		2		
CCH301-1-CO-1 : To solve examples on integration using various techniques	3	1	-	-	1	-	1		
CCH301-2-CO-2 : To solve Differential equation of first order and first degree by various methods	3	1	-	-	-	-	1		
CCH301-3-CO-3 : To find approximate solution of algebraic equations and simultaneous equations by various methods.	2	3	1	1	-	-	1		
CCH301-4-CO-4:- To solve problems on Probability distributions	2	1	1	1	1	1	1		
CCH301-5-CO-5:- Solve examples on Laplace Transform	2	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 Integration by substitution.	CCH301-1
2	Solve integration using by parts.	CCH301-1
3	Solve examples on Definite Integral based on given methods.	CCH301-1
4	Solve problems on properties of definite integral.	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)	CCH301-1
6	Solve examples on mean value and root mean square value.(only for Computer, Electrical and Electronics engg. group)	CCH301-1
7	Solve first order first degree differential equation using variable separable method.	CCH301-2
8	Solve first order first degree differential equation using exact differential equation and linear differential equation.	CCH301-2
9	Solve engineering application problems using differential equation.	CCH301-2
10	Solve problems on Bisection method, Regula falsi and Newton-Raphson method.	CCH301-3
11	Solve problems on Jacobi's method and Gauss Seidel method.	CCH301-3
12	Use Bakshali iterative methods for finding approximate value of square root.(IKS)	CCH301-3
13	Solve engineering problems using Binomial Distribution, Poisson Distribution and Normal Distribution.	CCH301-4
14	Solve problems on Laplace transform and properties of Laplace transform.	CCH301-5
15	Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	CCH301-5

II)Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO: CCH301-1 : To solve examples on integration using various techniques.			
Unit 1 Indefinite Integration	**Indefinite Integration** 1.1 Definition, Standard formulae 1.2 Rules of Integration (without proof), Examples 1.3 Integration by substitution 1.4 Integration by parts 1.5 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction)	14	16
CO: CCH301-1 : To solve examples on integration using various techniques			
Unit 2 Definite Integration	**Definite Integration** 2.1 Definition, Examples 2.2 Properties of Definite Integration (without proof), Examples based on properties	8	8
CO: CCH301-2 : To solve Differential equation of first order and first degree by various methods			
Unit 3 Differential equation	**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
CO: CCH301-3 :- To find approximate solution of algebraic equations and simultaneous equations by various methods.			
Unit 4 Numerical Methods	**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.	10	14

	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)		
CO: CCH301-4:- To solve problems on Probability distributions			
Unit 5 **Probability Distribution**	**Probability Distribution** 5.1 Binomial distribution 5.2 Poisson's distribution 5.3 Normal distribution	8	8
CO: CCH301-5:- Solve examples on Laplace Transform .			
Unit 6 **Laplace Transform**	**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)

- **Tests**

ii) Summative Assessment (Assessment of Learning)

- **End term exam**

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 in R	Gareth James,Hastie Robert & Tibshirani	Springer New York Heidelberg Dordrecht London ISBN:978-1-4614-7138-7(eBook)

L) Learning Website & Software

a) http://nptel.ac.in/courses/106102064/1
b) https://www.woframalpha.com/
c) http://www.sosmath.com/
d) http://mathworld.wolfram.com
e)https://www.brilliant.org/
f)https://ocw.mit.edu/index.htm

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COURSE ID :
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 . (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:-

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:

i) Sketching and labeling the diagrams for extraction of copper
ii) Experimentally analyzing the water samples for preparing portable water by different methods.
iii) Preparing chart of showing percentage, composition, properties and industrial applications of solders.
iv) 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 / 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**	**PSO2**
CCH104-1 CO-1 Apply the basic knowledge of atom, molecules and compounds in Engineering Chemistry.	3.0	2.0	-	1.0	3.0	1.0	3.0		
CCH104 - 2 CO-2 Apply the concepts of Electrochemistry to interpret the reasons of corrosion with its remedies.	3.0	2.0	-	1.0	2.0	1.0	3.0	-	-
CCH104 -3 CO-3 Select the relevant catalyst, alloys, insulators, adhesives, composite materials, plastic and rubber for different applications in the field of engineering.	3.0	1.0	-	-	2.0	1.0	3.0	-	-
CCH104 – 4 CO-4 Use of water in Domestic purpose, Industrial purpose and its relevant treatment to solve industrial problems.	3.0	2.0	-	1.0	3.0	1.0	3.0	-	-
CCH104-5 CO-5 Explain the method of Extraction of Iron.	3.0	1.0	-	-	2.0	1.0	3.0	-	-
CCH10- 6CO-6 Choose appropriate with relevant method of lubrication to solve industrial problem and applications of Paint and Varnish.	3.0	2.0	-	1.0	2.0	1.0	3.0	-	-

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
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.	**07**	**08**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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.		
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 - Hot dipping (Galvanizing & Tinning) ,Metal spraying, Metal cladding, Cementation or sherardizing.	**10**	**10**
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.	**13**	**16**

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	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 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.	**09**	**12**

	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.		
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. 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.	**12**	**14**
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	**09**	**10**

	& its fuctions – Drying oil (Vehicle), Drier, Pigment, Thinner, Filler (Extenders), Plasticizer. 6.5 Varnish – Definition, types, constituents, Properties & applications. 6.6 Distinction between paint & varnish.		

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

G : List of 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.	**Author**	**Title**	**Publisher**

No.			
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 :
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				
	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. : 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	PSO2
Competency: Communicate in written and oral form of English effectively at workplace.	2	-	-	-	-	1	2		
CCH201-1 Use Contextual words in English appropriately.	1	1	-	-	-	2	1		
CCH201-2 Comprehend the concept of communication and identify communication barriers	2	1	-	-	-	2	2		
CCH201-3 Prepare and participate in dialogue, conversation, elocution and debate.	2	1	-	-	-	2	1		

CCH201-4 Make effective use of body language & graphical communication.	2	-	-	-	-	2	2		
CCH201-5 Write letters, reports, e-mails and technical description in correct language.	2	-	-	-	-	2	1		
CCH201-6 Prepare and present effective media aided presentation.	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 6.2Planning, Preparing and Making a Presentation 6.3Use 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

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	NA
2	Preparedness for practical	NA
3	Neat & complete Diagram.	NA
4	Observations & handling of instrument.	NA
5	Oral Based on Lab work and completion of task	NA
TOTAL		

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

a. www.nptel.com/iitm/
b. https://www.britishcouncil.in/english/learn-online
c. https://www.vocabulary.com
d. www.newagegolden.com
e. https://www.internationalphoneticassociation.org

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COURSE ID :
COURSE NAME : SOCIAL AND LIFE SKILLS
COURSE CODE : CCH204
COURSE ABBREVIATION : HSLS

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				BASED ON SLA		TOTAL
					Practical						
	FA-TH	SA-TH	TOTAL		FA –PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
00	00	00	00	00	25	10	-	-	25	10	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 toeasily 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 andeventually 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

CCH204-1 - Develop ability to adapt to new challenges. CCH204-2 - Manage emotions effectively.
CCH204-3 - Follow workplace ethics and practices. CCH204-4 - Manage time effectively.
CCH204-5 - 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, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1	PSO2
Competency: Exhibit psychosocial competencies, workplace ethics, resilience, positive attitude, integrity and self-confidence.									
CCH204-1 Develop ability to adapt to new challenges.						1	2		
CCH204-2 Manage emotions effectively.						1	2		
CCH204-3 Follow workplace ethics and practices.						1	2		
CCH204-4 Manage time effectively.						2	2		
CCH204-5 Increased self-confidence to handle stress.						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.
	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the localproblems TLO 1.3 Design a methodology for fieldwork	**Unit - I MODULE I : Activities UnderUnnat Maharashtra Abhiyan (UMA)** 1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention 1.2 Multidisciplinary approach-linkages of academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets	Implementation Methodology: Considering the nature of the course designed, following points shall be considered while implementing the course. i) Regroup in the batches of 5-6 students for conducting the fieldwork

	TLO 1.4 Select the attributes of engineering and socialsystem 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.	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) 1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuringequipments 1.8 Format for measurement of identified attributes/ survey form and piloting of the same 1.9 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 1.10 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 datacollected.	from the bigger group. ii) Assign a few batches of the students for this course to all thefaculty 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 teacherswill 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 sessionsand 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 surveyinstrument Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Datagathering

			Summary Visit - Closure afteranalysis
2	TLO 2.1 Adoption of Village or Slum TLO 2.2 Survey and Problem IdentificationTLO 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 theNSS 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 andKaruna) 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 TLO 3.8 Gender Equality and Sensitivity	**Unit - III MODULE-III : Universal Human Values** 3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) 3.2 Truth (Satya) : Introduction, Practicing Truth (Satya) 3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) 3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) 3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) 3.6 Service (Seva) : Introduction, Practicing Service (Seva) 3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga Gender Equality and Sensitivity: Introduction, Practicing Gender Equality andSensitivity	i) Lectures ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks byPractitioners Site/Industry Visit
4	TLO 4.1 Punctuality TLO 4.2 Cleanliness, Hygiene and Orderliness TLO 4.3	**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	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Chalk-Board

	Responsibility TLO 4.4 Gratitude andAppreciations 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 andForget	Impression, Give word list for a Word based 4.2 Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting gestures, Gender Equality and Sensitivity 4.3 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 4.4 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, Topicsfor Public Speaking, Placement Process , OCSEM-E-Newspaper, Critical Thinking to overcome challenges 4.5 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, Word List for Word based Learning 4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics 4.7 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 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 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 Importanceof Insurance TLO 5.8 Literacy About the Dos and Don'ts in finances	**Unit - V MODULE-V : Financial Literacy** 5.1 Introduction - Life Goals and financial goals 5.2 Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments 5.3 Retirement planning 5.4 Cashless transactions 5.5 Income, expenditure and budgeting – Concepts and Importance 5.6 Inflation- Concept, effect on financial planning of an individual 5.7 Loans – Types, Management of loans, Tax benefits 5.8 Insurance – Types, Advantages, selection Dos and Don'ts in Financial planning and Transactions	i) Online/Offline Mode ofInstructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board Collaborative learning

** 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 heritageamong 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.

© Programmes aimed at creating an awareness for improvement of the status of women:

(i) programmes of educatingpeople 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 thecommunity;

(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided theyacquire 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 ofpatients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.

(ii) work with the organisations of child welfare;

(iii) work in institutions meant for physically and mentally handicapped;

(iv) organising blood donation, eye pledge programmes;

(v) work in Cheshire homes, orphanages, homes for the aged etc.;

(vi) work in welfare organisations 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) popularisation 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 immunisation, 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 forinstruction and recreation, programmes of community singing, dancing etc.;
(vi) organisation 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)

ii) 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 Healthand Environmental Engineering Organisation	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

a. https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf (Government Resolution of

Government of Maharashtra regarding Unnat Maharashtra Abhiyan)

b. https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf (Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines)
c. https://censusindia.gov.in/census.website/ (A Website of Census of India)
d. https://gsda.maharashtra.gov.in/english/ (A Website of Groundwater Survey and Development Agency, GoM)
e. https://mrsac.gov.in/MRSAC/map/map (A Website where district-wise mapsshowcasing

***

COURSE ID: ME
Course Name : ENGINEERING DRAWING (ME/MT)
Course Code : CCH110
Course Abbreviation: HEDR
Course Type : AEC

A. LEARNING SCHEME:

Pre-requisite Course(s): Nil

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:

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	
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	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**

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 for Parctical	05
3	Presentation (neat figures/ drawing etc.)	05
4	Drawing / drafting skills	05
5	Understanding	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 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. http://www.design-technology.info/IndProd/drawings/
2. http://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/
3. http://en.wikipedia.org/wiki/Engineering_drawing
4. http://www.engineeringdrawing.org/
5. http://www.teachengineering.org/view_activity
6. www.howtoread.co.in/2013/06/how-to-read-ed.html
7. http://www.slideshare.net/akhilrocker143/edp
8. http://www.24framesdigital.com/pstulpule

* * *

COURSE ID :
COURSE NAME : BASIC METALLURGY
COURSE CODE : MTH301
COURSE ABBREVIATION : HBME

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	02
	Tutorial Learning	--	
	Laboratory Learning	01	
	SLH-Self Learning	--	
	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	
03	30	70	100	40	25	10	--	--	--	--	125

(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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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

Basic metallurgy mainly deals with topics required for understanding metallurgical courses. This course is a collection of widely different basic topics such as atomic structure, fuels, plastic deformation, refractories, furnace technology, conceptual understanding of structure of solid materials and their properties.

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. Recommend appropriate fuel for given furnace.
2. Select suitable refractories for particular furnace.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

1. Familiar with material structure and properties.
2. Compare cold working and hot working.
3. Select particular fuel for given application.
4. Understand appropriate use of refractory.
5. Understand working of various temperature measuring devices.

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 To prepare the students to play the role of metallurgist in industries**	**PSO2 To create awareness about safety protocols to be followed in various metallurgical industries**	**PSO3 Develop sensitivity among the students about the environmental hazards caused due to the pollutants generated in metallurgical industries**
CO-1 : Familiar with material structure and properties.	3	2	2	1	2	1	1	1	1	2
CO-2 : Compare cold working and hot working.	3	1	1	2	2	--	1	2	1	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 To prepare the students to play the role of metallurgist in industries**	**PSO2 To create awareness about safety protocols to be followed in various metallurgical industries**	**PSO3 Develop sensitivity among the students about the environmental hazards caused due to the pollutants generated in metallurgical industries**
CO-3 : Select particular fuel for given application.	3	2	1	2	2	1	2	3	3	3
CO-4 : Understand appropriate use of refractory.	3	3	2	2	2	1	2	3	1	1
CO-5 : Understand working of various temperature measuring devices.	3	2	1	1	1	1	1	3	1	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 experiences	CO
1	Crystal structures and planes – F.C.C., B.C.C., H.C.P. structures to be studied with the help of models, sketching structures and planes.	1
2	Proximate analysis of coal and coke: Determination of moisture content, volatile matter and ash content of coal and coke.	3
3	Calorific value of fuel: Determination of calorific value of coal and coke by using bomb calorimeter.	3
4	Study of burners.	3

Sr. no	Laboratory experiences	CO
5	Properties of refractories: Determination of cold crushing strength and porosity of different refractories.	4

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Familiar with material structure and properties			
1	**Introduction & Nature of Solids :** 1.1 Importance of metallurgy, branches of metallurgy and scope under Indian condition. 1.2 States of matter, types of structures, atomic structure of metals, number of atoms per unit cell, determination of atomic packing factor and density of metal, allotropy, miller indices for planes and directions. 1.3 Imperfections in the crystals: Point, line and surface. 1.4 Polymorphism 1.5 Draw planes and directions for crystal structure (IKS learning).	07	12
CO2: Compare cold working and hot working			
2	**Plastic Deformation:** 2.1 Grain structure, hot working, cold working, annealing, recrystallisation, recovery and grain growth. 2.2 Structures of silicates, carbon, glasses 2.3 Polymeric structure. Ceramics and their comparison with metals (Strength to weight ratio). 2.4 Stress-Strain curve 2.5 Draw stress-strain curve for mild steel. (IKS learning).	06	09
CO3: Select particular fuel for given application. .			
3	**Solid Fuels:** 3.1 Classifications of fuels, solid fuels classification, properties, advantages, limitation and application, Occurrence/origin of coal with reference to Indian conditions. 3.2 Classifications of coal, peat, lignite, bituminous anthracite carbonization of coal-process, products and there uses, properties and uses of Metallurgical coke, bi-	10	14

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	products of coke. Use of pulverized and briquetted coal or coke. 3.3 Proximate analysis of coal and coke. 3.4 Selection criteria of fuel for particular application. Combustion Mechanism of coke. 3.5 Applications of solid fuels (IKS learning).		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO3: Select particular fuel for given application			
4	**Liquid, Gaseous Fuels and burners:** 4.1 Important properties and uses of various liquid fuels, resources of petroleum , classification of crude oil properties, refining of petroleum, products and uses petrol, diesel, kerosene and furnace oil. 4.2 Manufacture of gaseous fuels. Gaseous fuels composition. Properties and uses of Natural gas. Blast furnace gas, coke oven gas and liquefied petroleum gases, producer gas and LPG. 4.3 Study of types of flames, Burners required for combustion of liquid and gaseous fuels and their working principles, regenerators & recuperators. 4.4 Applications of liquid and gaseous fuels (IKS learning).	08	12
CO4: Understand appropriate use of refractory.			
5	**Refractory Materials**: 5.1 Classification of refractory, general properties such as refractoriness, porosity, chemical inertness, strength at elevated temperature. 5.2 Testing of refractories : PCE test. 5.3 Properties and Application of acidic refractories such as fireclay, silica, alumina etc. 5.4 Properties and Application of basic refractories such as magnesite, chromite. 5.5 Properties and application of neutral refractories such as carbon and special refractories like insulation materials, , zirconia, cer-wool 5.6 Application of refractory materials (IKS learning).	07	12
CO5: Understand working of various temperature measuring device.			

6	**Furnace Technology:** 6.1 Basic types of furnaces. 6.2 Refractories used in furnaces, different fuels used in furnaces. 6.3 Types of furnaces – Shaft, reverberatory, coke fired furnace. 6.4 Temperature measuring devices : Thermocouple – Seebeck effect, Thomson effect, Peltier effect. requirements of thermocouple, types of thermocouple, Pyrometers – resistance pyrometer, disappearing filament optical pyrometer, total radiation pyrometer. 6.4 Applications of Thermocouples and Pyrometers in Metallurgical Industries (IKS learning).	07	11

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

G : 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 (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	**Introduction & Nature of Solids**	6	4	2	12	**MTH301**-1
I / 2	**Plastic Deformation**	3	3	3	09	**MTH301**-2
I / 3	**Solid Fuels**	4	4	6	14	**MTH301**-3
II /4	**Liquid, Gaseous Fuels and burners**	4	4	4	12	**MTH301**-3
II /5	**Refractory Materials**	2	6	4	12	**MTH301**-4
II / 6	**Furnace Technology**	3	4	4	11	**MTH301**-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	Operating Skills	05
	Drawing / drafting skills	05
Affective	Attendance/Discipline and punctuality	05

TOTAL	25

ii) Summative Assessment of Practical : Not Applicable

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**

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, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

S.N.	Name of Book	Author	Publication
1	Material Science and Metallurgy for Engineer	Dr. V.D. Kodgire	Everest Publishing House
2	Elements of Metallurgy	D. Swarup	Rastogi Publication, Meerut. ISBN-10: 8171338135 ISBN-13: 788171338139
3	Fuels & Refractories	Gilchrist J.D.	Perganson. ISBN-10:0080204295 ISBN13:9780080204291
4	Elements of Fuels, Refractories	O.P.Gupta	Oxford Press. ISBN-10:8174090886 ISBN13:9788174090881

M) Learning Website & Software

1. http://nptel.ac.in/courses/112107144/10
2. Youtube – crystal structure, solid fuels, liquid fuels, gaseous fuels, refractory materials.

***

COURSE ID :
COURSE NAME : Metallurgical Workshop Practice - II
COURSE CODE : MTH102
COURSE ABBREVIATION : HWMT-II

A. LEARNING SCHEME:

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

B. ASSESSMENT SCHEME :-

PAPER DURATION IN HRS	THEORY				BASED ON LL&TL				BASED ON SLA		TOTAL
					Pracctical						
	FA-TH	SA-TH	TOTAL		FA -PR		SA-PR				
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
--	--	--	--	--	25	10	50@	20	--	--	75

(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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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 course is mainly deals with Metal Joining Processes, Sheet Metal Forming Processes, and Fitting work. Theses processes are commonly used in Engineering Industry. A technician has to work in such 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. Such working upgrades the mental and manual abilities / skills of using efficiently the basic tools in most of the industries. The students are required to supervise, maintain equipments, where he needs the knowledge of basic workshop skills such as welding, sheet metal and fitting processes.

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. Demonstrate various welding processes, sheet metal forming processes and fitting work.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

MTH102-1 Select different types of welding, sheet metal forming and fitting tools for particular application.
MTH102-2 Prepare a job with welding, sheet metal forming and fitting process.
MTH102-3 Select a precise welding method for a given job.
MTH102-4 Practicing safety in workshop.

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** To prepare the students to play the role of metallurgist in industries	**PSO2** To create awareness about safety protocols to be followed in various metallurgical industries	**PSO3** Develop sensitivity among the students about the environmental hazards caused due to the pollutants generated in metallurgical industries.
CO-1 Select different types of welding, sheet metal forming and fitting tools for particular application	3	2	2	2	2	2	3	3	1	2
CO-2 Prepare a job with welding, sheet metal forming and fitting process	3	1	3	3	1	2	3	2	2	2
CO-3 Select a precise welding method for a given job	3	2	2	2	2	2	3	3	1	2
CO-4 Practicing safety in workshop	3	2	2	1	2	2	2	2	3	3

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 experiences	CO
1	**Welding Shop** - Demonstration of various welding tools, joints of metals, type of welding machines.	1
2	Demonstration of arc welding techniques.	3
3	How to use current setting, earthing connection etc. and any one job involving Butt, Lap joint from the following pieces of work - Window frame, Grill, Sanitary window frame, Supporting frame, Stool frame, Bench frame etc. measure dimensions.	2
4	Safety precautions during welding.	4
5	**Sheet Metal Shop** - Demonstration of different sheet metal tools and machines.	1
6	Demonstration of sheet metal operations like marking, sheet cutting, hemming, bending, edging, end curling, lancing, riveting etc.	2
7	One job involving sheet metal operations from Dustbin, Letter Box, Tray, Bucket etc.	2,4
8	**Fitting Shop** - Demonstration of different fitting tools, drilling and power tools.	1
9	Demonstration of different operations like marking, filing, cutting, drilling, tapping etc.	2
10	One simple fitting job (Male Female assembly type involving practice of filing, drilling, cutting, tapping etc.)	2,4

II) Theory - NA

G : List of Assignments under SLA
NA

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 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 50 marks as per following criteria:

Sr. no	**Criteria**	**Marks allotted**
1	Knowledge about the course	10
2	Preparedness for practical /Oral	10
3	Neat & complete Diagram/write up	10
4	Observations/Handling of instrument/ Communication/Presentation	10
5	Oral Based on Lab work and completion of task	10
TOTAL		**50**

J) Instructional Methods:

1. Demonstration during Practicals.
2. Workshop Record Book.

K) Teaching and Learning resources:

1. Shop Demonstration,
2. Hands on training on machine.

L) Reference Books:

S.N.	Name of Book	Author	Publication
1	Elements of workshop Technology – Volume I & II	S. K. Hajra Chaudhary, Bose, Roy	Media Promoters and Publishers limited
2	Elements of workshop Technology – Volume I & II	B.S. Raghuvanshi	Dhanpat Rai & Co.

M) Learning Website & Software

1. http://nptel.ac.in
2. You Tube – Welding, Sheet Metal, Fitting.

***

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	**: MT**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Third**	**Scheme**	**: H**

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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	Metallurgical Thermodynamics	HMTH	DSC	3	MTH302	2	3	1	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
2	Metallurgical Analysis	HMA	DSC	3	MTH303	2	3	--	2	1	6	3	3	30	70	100	40	25	10	--	--	25	10	150
3	Foundry Technology - I	HFT-I	DSC	3	MTH304	2	3	--	2	1	6	3	3	30	70	100	40	--	--	25	10	25	10	150
4	Physical Metallurgy-I	HPHM-I	DSC	3	MTH305	2	3	--	2	1	6	3	3	30	70	100	40	--	--	25	10	25	10	150
5	Iron Making	HIM	DSC	3	MTH306	2	4	--	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
6	Mechanical Engineering	HME	DSC	3	MTH307	--	3	--	2	1	6	3	3	30	70	100	40	--	--	--	--	25	10	125
7	Auto CAD & 3-D Modelling	HATM	DSC	3	MTH308	--	1	--	4	1	6	3	--	--	--	--	--	--	--	50	20	25	10	75
8	Essence of Indian Constitution	HEIC	VEC	2	CCH205	4	1	--	--	1	2	1	--	--	--	--	--	--	--	--	--	50	20	50
Total							21	1	12	6	40	20				600		25		100		175		900

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

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

PBOS Secretary
Metallurgical Engg. Dept.

H.O.D.
Metallurgical Engg. Dept.

CDC Incharge
G.P. Kolhapur

COURSE ID :
COURSE NAME : Metallurgical Thermodynamics
COURSE CODE : MTH 302
3COURSE ABBREVIATION : EMTH

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	02
	Tutorial Learning	01	
	Laboratory Learning	--	
	SLH-Self Learning	--	
	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	
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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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

The enormous metallurgical industries require enormous energy. The energy sources are limited. Therefore it is necessary to understand the principles underlying energy requirements in these industries so that minimum energy input may be achieved. The thermodynamics laws and their applications contribute towards this understanding. Basic terms such as energy, system, path and state properties, extensive and intensive properties, etc, are required to understand these thermodynamics laws and therefore covered in the present course.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understand the fundamental principles underlying the metallurgical processes with reference to the temperature, pressure and energies.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Use fundamentals and terms to understand thermodynamic principles
2. Use first law of thermodynamics and Hess's law to understand thermodynamic reactions
3. Use second law of thermodynamics to understand thermodynamic reactions
4. Use third law of thermodynamics, Roult's law, Henry's law and sievert's law to understand thermodynamic reactions
5. Use Ellingham Diagram to predict the conditions under which an ore will be reduced to its metal.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO1 - Use fundamentals and terms to understand thermodynamic principles	3	3	2	3	2	3	2	3	3	2
CO2 - Use first law of thermodynamics and Hess's law .	3	3	2	3	2	3	2	2	3	3

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO3 - Use second law of thermodynamics	3	3	2	3	2	2	2	2	3	3
CO4 - Use third law of thermodynamics, Roult's law, Henry's law and sievert's law.	3	3	2	3	2	2	2	2	2	2
CO5 - Use Ellingham Diagram.	3	3	2	2	2	2	2	3	3	2

F. CONTENT:-

I) Practical exercises – not applicable

Sr. No.	Topic / Subtopic	Hours	Marks
	Section I		
CO1 - Use fundamentals and terms to understand thermodynamic principles			
1	**INTRODUCTION: SCOPE, CONCEPTS AND TERMS OF THERMODYNAMICS.** 1.1 Definition of thermodynamics, scope of metallurgical thermodynamics. 1.2 Energy- concepts , properties, forms, and sources of energy. 1.3 Thermodynamic system and its classification. State of systems 1.4 Extensive and insentive properties, equation of state. 1.5 Thermodynamic processes: isobaric, isothermal, isochoric, adiabatic and polytropic. Path and state functions, standard state Thermodynamic equilibrium, reversible and irreversible processes	**10**	**16**
CO2 - Use first law of thermodynamics and Hess's law to understand thermodynamic reactions			
2	**FIRST LAW OF THERMODYNAMICS** 2.1 Statements and formulation of first law of thermodynamics. 2.2 Internal energy as a state property. 2.3 Heat capacity: specific heat at constant volume and constant pressure, relation between Cp and Cv. 2.4 Enthalpy : definition and mathematical expression Thermo -chemistry: exothermic and endothermic reactions. 2.5 Hess's law – statement and significance. calculation based on Hess's law	**10**	**16**

Section II			
CO3 - Use second law of thermodynamics to understand thermodynamic reactions			
3	**SECOND LAW OF THERMODYNAMICS** 3.1 Statement and mathematical expression of second law of thermodynamics. 3.2 Concept of entropy, entropy change associated with thermodynamic processes. Calculation of entropy of the reaction. Significance of entropy. 3.3 Combine statement of first and second law, Concept of Free energy, Expression of Helmotz free energy and Gibbs free energy. 3.4 Change in free energy as criteria for deciding nature of process. Fugacity and activity	**10**	**14**
CO4 - Use third law of thermodynamics ,Roult's law,Henry's law and sievert's law to understand thermodynamic reactions			
4	**THIRD LAW OF THREMODYNOMICS** 4.1 Statement of law and its significance. 4.2 Zeroth law of thermodynamics and its significance Phase rule Free energy-temperature relation and relative stability of phases. 4.3 Equilibrium constant for chemical reactions. 4.4 Ideal solution- activity coefficient , Roult's law and Henry's law, Sievert's law and its significance	**10**	**14**
CO5 - Use Ellingham Diagram to predict the conditions under which an ore will be reduced to its metal.			
5	**ELLINGHAM DIAGRAMS** 5.1 General form of Ellingham diagram. 5.2 Oxide and sulphides Ellingham diagrams. 5.3 Characteristics of Ellingham diagrams 5.4 Significance of diagrams- reduction and dissociation of oxides. 5.5 Intersecting lines on Ellingham diagrams.	**05**	**10**

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

G. List of Assignment 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		
1.	Introduction	6	6	4	16	1
2.	First law of thermodynomic	6	6	4	16	2
3.	Second law of thermod.	4	6	4	14	3
4.	Third law of thermod.	4	6	4	14	4
5.	Ellingham diagrams	2	4	4	10	5
Total		**22**	**28**	**20**	**70**	
	Total Marks				70	

I. Assessment Criteria : 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, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Title	Author, Publisher, Edition and Year Of publication
1.	Metallurgical thermodynamics	R.H. Tupkary, Tu publishers Nagpur,first edition,1995
2.	Problems in metallurgical thermodynamics and kinetics	G. S. Upadhyaya, Publisher Pergamon, first edition

M. Learning Website & Software

1. https://www.nist.gov/thermodynamics

2. https://www.grc.nasa.gov/www/k-12/airplane/thermo.html

***

COURSE ID :
COURSE NAME : METALLURGICAL ANALYSIS
COURSE CODE : MTH303
COURSE ABBREVIATION : HMA

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	01	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	--	--	25	10	150

(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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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

The chemical analysis of metals and alloys determine their mechanical and physical properties. Application of chemical analysis technique to develop new alloys. In medium and large scale industries, instrumental techniques are common. In many small-scale industries, wet chemical analysis methods are commonly used. Thus a Metallurgical Engineer needs to be conversant with various techniques used for chemical analysis of metals and alloys.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Handling various instruments, apparatus for chemical analysis of metals and alloys.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Use fundamentals of chemical analysis.
2. Practice gravimetric analysis for chemical analysis.
3. Practice volumetric analysis for chemical analysis.
4. Use various instrumental methods of chemical analysis.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Use fundamentals of chemical analysis	3	2	1	1	2	--	3	3	3	2
CO-2 : Practice gravimetric analysis for chemical analysis.	3	2	1	1	2	--	3	3	3	2
CO-3 : Practice volumetric analysis for chemical analysis.	3	2	1	1	2	--	3	3	3	2
CO-4 : Use various instrumental methods of chemical analysis	3	2	1	1	2	--	3	3	2	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 experiences	CO
1	Introduction of the equipments used in the metallurgical analysis laboratory	1
2	Preparation of standard and dilute solution	1
3	Determination of silicon in steel by using gravimetric analysis method	2
4	Determination of phosphorous in steel by using gravimetric analysis method	2
5	Determination of manganese in steel by volumetric analysis method	3
6	Determination of carbon in steel by using strohlein apparatus	3
7	Study of atomic emission spectrometer	4

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Use fundamentals of chemical analysis.			
1	**Introduction :** 1.1 Sampling methods of metals & alloys, 1.2 Equipments used in chemical laboratory, 1.3 Preparation of standard and dilute solution, 1.4 Comparison between Qualitative & Quantitative analysis, 1.5 Accuracy, precision, error, presentation of analysis, observation & computation. IKS – History of chemical analysis.	10	14
CO2: Practice gravimetric analysis for chemical analysis.			
2	**Gravimetric analysis :** 2.1 Chemical balances & their precision, 2.2 Solubility product, 2.3 Requirement of precipitated form, 2.4 Condition of Precipitation and Masking, 2.5 Filtration, Drying & Igniting of Precipitate, 2.6 Weighing & requirement of weigh form, 2.7 Determination of weight % of element from precipitate, 2.8 Merits & Demerits of methods,	12	20

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	2.9 Simple examples on Gravimetric analysis.		

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO3 : Practice volumetric analysis for chemical analysis.			
3	**Volumetric Analysis :** 3.1 Analysis, Titration, 3.2 Standardization of solutions, 3.3 Use of Indicators & their properties, 3.4 Requirement of volumetric reaction, 3.5 Acid & alkalis, examples, 3.6 Titration of oxidizing & reducing solutions, 3.7 Advantages & Disadvantages of these method. 3.8 Colorimetry	12	20
CO4 : Use various instrumental methods for chemical analysis.			
4	**Instrumental Methods :** 4.1 Determination of carbon & sulphur by combustion method, 4.2 Study of strohlein apparatus for determination of C in steel 4.2 Electro-gravimetric analysis, 4.3 Photo-electric calorimeter/Spectrometer, 4.4 Principle of spectroscopic analysis, 4.5 Introduction to Emission & atomic absorption spectrometer, 4.6 Advantage of these methods.	11	16

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

G. List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Apply coning and quartering as a sampling method	2
2	Practice use of various equipments in chemical laboratory	2
3	Use steps of gravimetric analysis for any alloy.	2
4	Use steps of volumetric analysis for any alloy.	2
5	Compare volumetric analysis with gravimetric analysis.	2

6	Practice various instrumental methods for chemical analysis of different alloys.	3
7	Determine % carbon in steel by strohlein apparatus	2

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	6	6	2	14	1
I / 2	Gravimetric analysis	6	10	4	20	2
II / 3	Volumetric analysis	4	10	6	20	3
II /4	Instrumental Methods	4	8	4	16	4
	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 : Not Applicable

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**

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, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Quantitative Analysis	V. Alexeyev	MIR Publishers
2	Text Book Of Metallurgical Analysis	B.C. Agarwal & S.P. Jain	Khanna Publisher, N. Delhi

M. Learning Website & Software

https://en.wikipedia.org/wiki/Analytical_chemistry
https://en.wikipedia.org/wiki/Wet_chemistry

***

COURSE ID :
COURSE NAME : FOUNDRY TECHNOLOGY - I
COURSE CODE : MTH 304
COURSE ABBREVIATION : HFT- I

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	3	3
	Tutorial Learning	--	
	Laboratory Learning	2	
	SLH-Self Learning	1	
	NLH- Notional Learning	6	

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	150

(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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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

To enable Metallurgy engineer to understand the concept of manufacturing processes with reference to Metal industry. This course deals with the fundamentals of foundry processes. It covers the tooling, details of the manufacturing steps as well as various standard types used to suit the requirement of casting.

ii)**INDUSTRY / EMPLOYER EXPECTED OUTCOME**

Familiarize with the entire manufacturing process of casting.

E. COURSE LEVEL LEARNING OUTCOMES(COS)

1. Understand the sections in foundry cores, molding, melting.
2. Use various pattern, and pattern allowances
3. Prepare mold and, identify types of cores.
4. Use other molding and casting processes.
5. Use of miscellaneous molding processes.
6. Use of various types fettling tools.

Competency, course outcomes and programme outcomes /programme specific 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO1-Understand the sections in foundry	3	3	2	2	2	2	2	3	3	2
CO2-Use various Pattern, and pattern allowances	3	3	2	3	2	3	2	2	3	3
CO3-Prepare the mold and identify types of cores	3	3	2	3	2	2	2	2	3	3
CO4-Select and use various sand moulding processes	3	3	2	2	3	2	2	2	2	2

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO5-Select and use various permanent moulding processes	3	3	2	2	2	2	2	3	3	2
CO6-Use various types of fettling tools	3	3	2	2	3	2	2	2	3	3

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 experiences	CO
1	Study of various patterns, match plates etc.	2
2	Determination of various green sand properties	3
3	Producing Green sand mold.	3
4	Prepare Shell mold and core	4
6	Casting aluminum in gravity die casting and centrifugal die casting	5
7	Separation of casting from mould and cleaning of casting	6

II) Theory -

Section I

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
***Course Outcome** MTH 304-1 Understand the sections in foundry cores, molding, melting*			
1.	**Introduction:** What is Foundry Types of foundries Different Section in Foundry Foundry Layout Importance of foundry technology Casting v/s other manufacturing process	04	4

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
	Advantages & limitations of foundry process ***IKS** References of the castings found in excavation of ancient sites. Manufacturing of canons during middle Ages.		
Course Outcome MTH 304-2- *Use of Various Pattern, and pattern allowances*			
2.	**Pattern making:** I. Pattern material: Function of pattern, Material for pattern and core boxes such as metal, wood, wax, plaster, plastic, thermocol etc. II.Types of patterns: Loose, match plate, one piece (solid) pattern, split pattern, skeleton, segmental pattern, Sweep pattern, Comparison of various patterns III.Pattern design and construction Pattern allowances, pattern joints, parting line selection, loose pieces, colour codes for pattern. **Core Making:** Function of core, types of core boxes, Types of Core Print, calculation of core print support	08	14
Course Outcome MTH 304-3- *prepare the mold and, identify types of cores*			
3	**Sand Molding Processes:** Requirements of moulding sand, types of sands. I. Green Sand Moulding a. Ingredients of moulding sands b. Testing of Molding sand. c. Advantages and disadvantages of green sand moulding d. Venting e. Dry sand Moulding II. Core Making Characteristics of core sand, Types of cores, III. Additives in moulding and core making sands	08	14

Section II

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks
Course Outcome MTH 304-4-Select and use various sand moulding processes			

4	**Other sand molding and Core Making processes:** CO2 -Sodium Silicate process Shell sand process Cold box process (Principle/ ingredients, pattern and equipment, casting size/alloy range, application, advantages, limitations)	07	10
Course Outcome MTH 304-5-Select and use various permanent moulding processes			
5.	**Permanent Mold Casting** I.Die Casting- Gravity, High pressure- Hot chamber, Cold Chamber, Low pressure II.Centrifugal Casting-Types, advantages and disadvantages III.Continuous casting (Principle/equipment's, casting size alloy range, application, and limitations.)	07	10
Course Outcome MTH 304-5- Use of miscellaneous molding processes.			
6	**Miscellaneous Molding Process:** Plaster molding, ceramic molding, slush casting, Floor molding, Investment Casting	06	10
Course Outcome MTH 304-6 Use of various types fettling tools			
9	**Finishing operations.** Fettling, cleaning, finishing, Shotblasting, tumbling, sand blasting, grinding, chipping, cutting.	05	08
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.			

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

G. List of Assignments under SLA

1. Visit to any small foundry near you and find out the layout of the foundry.
2. Prepare a thermocoal pattern by providing all the allowances.
3. Prepare simple green sand mould by using any pattern available to your and make a video.
4. Operate a shell making machine and explain its advantages.
5. Produce an aluminum casting by using centrifugal mould.
6. Visit any industrial area nearby you and make a survey of the waste sand dumping site.
7. Find out the safety issues in the fettling shop of the foundry.
8. Make list of the casting defects observed due the moulding parameters.

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

Specification Table for setting question paper for semester end theory paper

Sr no	Topic	Distribution of Marks				Course Outcome
		Remember	Understand	Application		
1	Introduction	04	-	-	04	1
2	Pattern Making	06	04	04	14	2
3	Sand Molding	06	04	04	14	3
4	Other sand molding processes	04	04	02	10	4
5	Metal Mold Casting	04	04	02	10	5
6	Miscellaneous Molding Process	04	04	02	10	5
7	Finishing operations	-	04	04	08	6
	Total	28	24	18	70	

I. Assessment Criteria

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**

J. Instructional Methods:

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

K. Teaching and Learning Resourses :
Chalk board, LCD presentation, Self-Learning Online Tutorials.

L. Text-Books:

Author	Title	Publisher
P.L.Jain	Principles of Foundry Technology	Mcgraw Hill Education(India)

T. V. Ramana Rao	Metal Casting Principle and Practice	New Age International (P) Ltd,Publishers.
Richard W.Heine, Carl R Loper, Philip C Rosenthal	Principle of Metal Casting	Tata MacGraw Hill Publishing Comp.

Reference Books:

Author	Title	Publisher
-	Metal hand book no-6	American Soc. Of Metals

M. Learning Website & Software

1. https://nkn.gov.in/en/services-lt-en/community-services-lt-en/e-foundry-lt-en
2. https://www.indianfoundry.org/
3. https://www.afsinc.org/

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COURSE ID :
COURSE NAME : PHYSICAL METALLURGY - I
COURSE CODE : MTH305
COURSE ABBREVIATION : HPHM-I

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	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				150
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	30	70	100	40	--	--	25	10	25	10	

(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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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.

D. i) RATIONALE

This course deals with solidification of metals and alloys. Various types of equilibrium diagrams and their relationship between microstructure and properties of metals and alloys are studied in course. It also includes detail study of Iron-Iron Carbide Equilibrium Diagram which is very much important for study of various types of steels and cast iron. It also deals with metallography concept. The study of these concepts of physical metallurgy will develop skills in students to identify and interpret microstructures, grades and properties of steel, cast iron and non ferrous metals. Also the emphasis is laid on the properties and application of common metals and alloys.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Identify and interpret microstructures and properties of steel and cast iron.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

1. Understand the concept of solidification.
2. Plot various binary equilibrium diagrams and calculate amount of phases using Lever Rule.
3. Draw Iron Carbon Equilibrium Diagram.
4. Select the cast iron for particular application.
5. Prepare specimen for micro examination and operate Metallurgical Microscope for microscopic examination.
6. Select appropriate non-ferrous alloys for given 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Understand the concept of solidification.	3	1	2	1	--	--	2	1	1	1
CO-2 : Plot various binary equilibrium diagrams and calculate amount of phases using Lever Rule.	3	--	--	1	--	1	1	2	--	--
CO-3 : Draw Iron Carbon Equilibrium	3	--	--	--	--	--	1	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
Diagram.										
CO-4 : Select the cast iron for particular application.	3	--	1	1	2	2	2	3	1	1
CO-5 : Prepare specimen for micro examination and operate Metallurgical Microscope for microscopic examination	3	--	1	3	1	1	2	3	2	1
CO-6 : Select appropriate non-ferrous alloys for given applications.	3	1	2	2	3	2	2	3	1	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 experiences	CO
1	Draw Iron-Iron Carbide Equilibrium Diagram	2,3
2	Draw metallurgical microscope and explain its working.	5
3	Prepare micro-specimen for metallographic observation.	5
4	Prepare mounting specimen for microscopic examination.	5
5	Prepare etching reagent and use that on polished sample for microscopic examination.	5
6	Draw microstructures of various steels by microscopic observation.	5
7	Draw microstructures of various cast iron by microscopic observation.	4,5

Sr. no	Laboratory experiences	CO
8	Draw microstructures of various non-ferrous metals and alloys by microscopic observation.	6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Understand the concept of solidification			
1	**Solidification of Metals :** 1.1 Concept of solidification - Transformation of liquid in to solid. 1.2 Nucleation and growth, dendrite formation. 1.3 Grain and grain boundaries. 1.4 Cooling curves for pure metals and binary alloys. 1.5 Solid solutions - Substitutional solid solution, Interstitial solid solution. 1.6 Hume- Rothery's rules for formation of solid solution.	06	10
CO2: Plot various binary equilibrium diagrams and calculate amount of phases using Lever Rule			
2	**Equilibrium Diagram :** 2.1 Definition of phase. 2.2 Gibbs's phase rule and its application 2.3 Polymorphism 2.4 Equilibrium diagrams: Various reactions - eutectoid, eutectic and peritectic reactions. 2.5 Lever Rule: Its derivation and application to equilibrium diagram 2.6 Identification of microstructural changes with respect to equilibrium diagram.	06	08
CO3: Draw Iron Carbon Equilibrium Diagram			
3	**Iron Carbon Equilibrium Diagram** 3.1 Neat sketch of Iron Carbon Equilibrium Diagram. 3.2 Allotropic transformation of iron. 3.3 Reactions in Iron-Carbon Equilibrium Diagram. 3.4 Critical temperatures in Iron- carbon diagram. 3.5 Classifications of plain carbon steel with reference to iron carbon diagram. 3.6 Solidification and changes in microstructure with reference to Iron-Iron Carbide Equilibrium Diagram. 3.7 Microstructure and properties of plain carbon steel.	10	16

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4 : Select the cast iron for particular application			
4	**Cast Iron** 4.1 Cast iron: Definition, classification of cast iron, graphitization in cast iron, morphology of graphite. 4.2 Malleable Cast Iron: Production – Malleablizing heat treatment, microstructure, properties and applications. 4.2 Gray Cast Iron: Production, forms of graphite- A, B, C, D & E, flake size of graphite, ASTM size, relationship between microstructure & mechanical properties, composition, microstructure, properties and applications of gray cast iron. 4.3 Nodular Cast Iron: Production, Composition, microstructure, properties and applications of nodular cast iron. 4.4 Types of cast iron: Composition, microstructure, properties and applications of - White CI, chilled CI, high duty CI (Meehanite), alloy CI.	06	10
CO5 : Prepare specimen for micro examination and operate Metallurgical Microscope for microscopic examination			
5	**Microscopic Examination :** 5.1 Microscopy, specimen preparation, mounting of specimen, mechanical and electrolytic polishing,etching reagents and etching techniques, principle and working of optical metallurgical microscope. 5.2 ASTM grain size number and method for measurement of grain size.	05	08
CO6 : Select appropriate non-ferrous alloys for given applications			
6	**Metallurgy Of Nonferrous Alloys** 6.1 **Brasses**- Cu-Zn equilibrium diagram, Composition, mechanical properties and application of commonly used industrial brasses – cap copper, gilding metals, cartridge brass, admiralty brass, muntz metal, naval brass, leaded brass, high tensile brasses, brazing brass, Defects - orange peel, season cracking, dezincification. 6.2 **Bronzes**: Cu-Sn equilibrium diagram, mechanical properties and application of commonly used industrial bronzes, composition and properties of gun metal and phosphor bronze. 6.3 **Al alloys**: Properties, Al-Si alloy - equilibrium diagram, modification, compositions, LM series, Al-Cu alloy system, Duralumin. 6.4 **Bearing metals**: Classification of bearing metals,	12	18

	requirements of good bearing metal, composition, microstructure, mechanical properties and applications of lead base and tin base bearing metals, effects of copper addition on the properties of bearing metals.		

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

G. List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Explain concept of solidification of metal	3
2	Use lever rule to any equilibrium diagram	3
3	Prepare malleable cast iron	2
4	Prepare nodular cast iron	2
5	Draw changes in microstructure with % of carbon and temperature in Iron-Iron Carbide Equilibrium Diagram.	3
6	Draw microstructure of various bearing metals.	2

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	Solidification of Metals	4	6	--	10	1
I / 2	Equilibrium Diagram	2	3	3	08	2
I / 3	Iron Carbon Equilibrium Diagram	4	8	4	16	3
II /4	Cast Iron	2	4	4	10	4
II /5	Microscopic Examination	2	2	4	08	5
II / 6	Metallurgy Of Nonferrous Alloys	6	6	6	18	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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Material Science and Metallurgy for Engineer	Dr. V.D. Kodgire	Everest Publishing House
2	Introduction to Physical Metallurgy	Sidney H. Avner	Tata McGraw-Hill

M. Learning Website & Software

1. https://nptel.ac.in/courses/113105023
2.https://www.vssut.ac.in/lecture_notes/MME%20201%20_%20INTRODUCTION%20TO%20PHYSICAL%20METALLURGY.pdf
3. https://archive.nptel.ac.in/courses/113/105/113105024/

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COURSE ID :
COURSE NAME : IRON MAKING
COURSE CODE : MTH306
COURSE ABBREVIATION : HIM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	02
	Tutorial Learning	--	
	Laboratory Learning	--	
	SLH-Self Learning	--	
	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	
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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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

The extraction of ferrous metals from their ores is the stepping-stone in understanding the metallurgical courses. This course deals with the important extraction techniques involved in Ferrous Metallurgy. Emphasis is given on study of blast furnace, pig iron production and sponge iron production.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understand the working of blast furnace and chemical reactions occur in blast furnace.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Study the development of iron making.
2. Notify the roles of charging materials and importance of agglomeration.
3. Draw neat sketch of blast furnace.
4. Understand the working and various reactions of Blast Furnace.
5. Suggest the suitable remedies for varies irregularities in Blast Furnace and modern practices in Blast Furnace.
6. Explain production of sponge iron.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : 1. Study the development of iron making	3	1	1	2	3	1	2	1	1	3
CO-2 : Notify the roles of charging materials and importance of agglomeration	3	--	2	2	1	1	1	2	1	--
CO-3 : Draw neat sketch of blast furnace.	3	--	--	--	--	1	--	1	--	--
CO-4 : Understand the working and various reactions of Blast Furnace.	3	--	--	--	2	1	1	1	1	2

CO-5 : Suggest the suitable remedies for varies irregularities in Blast Furnace and modern practices in Blast Furnace.	3	3	3	2	2	2	2	3	3	2
CO-6 : Explain production of sponge iron.	3	2	2	2	1	1	1	2	1	1

F. CONTENT:-

I) Practical exercises – Not Application

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Study the development of iron making			
1	**Introduction:** 1.1 Ancient Iron Making Processes. 1.2 Development in Iron Making. 1.3 Modern Iron Making. 1.4 Alternative methods of Iron Production. 1.5 Introduction to Integrated Steel Plant. 1.6 Major Steel Plants in India. IKS – Ancient Iron Making in India.	6	8
CO2: Notify the roles of charging materials and importance of agglomeration			
2	**Burden Preparation for Blast Furnace:** 2.1 I**ron Ores** - Types. 2.2 **Fuel :** Coke- Properties, functions. 2.3 **Fluxes** – Types, functions. 2.4 **Beneficiation of Iron ore -** Purpose**,** methods of beneficiation. 2.5 **Agglomeration** – Purpose, classification. a. **Sintering** - Principle, process : Dwight-Lloyed sintering machine, advantages. b. **Pelletisation** - Principle, process : disc pelletiser, drum pelletiser, advantages. 2.6 Burden qualities.	10	12

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	2.7 **Burden Distribution**- Introduction		
CO3: Draw neat sketch of blast furnace			
3	**Blast Furnace Construction :** 3.1 Constructional details and functions of Blast Furnace parts : a. Stack b. Bosh c. Hearth d. Bustle pipe e. Tuyers 3.2 Refractories used in Blast furnace. 3.3 Burden charging systems. 3.4 **Gas Cleaning System -** Functions a. Dust catcher – Working b. Scrubbers - Working c. Electrostatic Precipitator – Working. 3.5 **Hot blast stove**- Construction, refractories used, working.	14	14

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4: Understand the working and various reactions of Blast Furnace			
4	**Blast Furnace Operation :** 4.1 Working principle of blast furnace. 4.2 Operations of blast furnace. 4.3 Chemical reactions at different zones in Blast Furnace, temperature profile in Blast Furnace. 4.4 Blast Furnace products-– Composition of pig iron, slag and gases. 4.5 Behavior of S, P, Zn and alkali metals. 4.6 Average quantity of charge required per ton of pig iron production.	10	12
CO5: Suggest the suitable remedies for varies irregularities in Blast Furnace and modern practices in Blast Furnace.			
	Irregularities & Modern Trends in Blast Furnace 5.1 Irregularities in Blast Furnace operation and their remedies a. Hanging, b. Scaffolding,		

5	c. Chilled Hearth, d. Pillaring, e. Breakout, f. Channeling. 5.2 Modern trends in Blast Furnace practice : a. High top pressure, b. Oxygen Enrichment of blast, c. Humidification of blast, d. Higher blast temperature.	10	12
CO6: Explain the alternative route of iron production			
6	**Sponge Iron Production** 6.1 Necessity of alternative route of iron production 6.2 Sponge Iron – Definition, contents. 6.3 Physical chemistry of Sponge Iron processes. 6.4 Sponge Iron making processes– a. HyL Process, b. Midrex Process, c. Rotary Kiln Process. 6.5 Sponge Iron Making in India 6.6 Uses of Sponge Iron. IKS – Other alternative route of iron production.	10	12

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

G. 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 (level wise)			Total marks	CO
		Remember	Understand	Apply		
I / 1	Introduction	3	3	2	08	1
I / 2	Burden Preparation for Blast Furnace	4	4	4	12	2
I / 3	Blast Furnace Construction	6	6	2	14	3
II /4	Blast Furnace Operation	4	6	2	12	4
II /5	Irregularities & Modern Trends in Blast Furnace	4	6	2	12	5
II / 6	Sponge Iron Production	4	4	4	12	6
	Total Marks				70	

I. Assessment Criteria

i) Formative Assessment of Practical :- Not Application

ii) Summative Assessment of Practical : 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, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	An Introduction to Modern Iron Making	Dr. R.H. Tupkary, V.R. Tupkary.	Khanna Publication, 4th Edition, 2016
2	An Introduction to Modern Steel Making	Dr. R.H. Tupkary, V.R. Tupkary.	Khanna Publication, 7th Edition, 2017
3	General Metallurgy	Boris Kuznestsov,	Mir Publishers, Moscow, 2nd Edition,1979

M. Learning Website & Software

1. https://nptel.ac.in/courses/113/108/113108079/
2. https://www.youtube.com/watch?v=ysLqUDa5GEA
3. https://www.youtube.com/watch?v=hBqhGHfzQFQ

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COURSE ID :
COURSE NAME : **Mechanical Engineering**
COURSE CODE : **MTH 307**
COURSE ABBREVIATION : **HME**

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	03	03
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	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	125
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			
	30	70	100	40	--	--	--	--	25	10	

(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 Note : (TNR 11 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

Metallurgy Engineers often come across various engg. Components for selection of materials and manufacturing processes .They are required to know basic principles of working of different machines and equipments. They are also required to look after the maintenance of the machines. He should know the reading of pattern drawings, various symbols and assembly and details. The basic knowledge of I.C.Engines, Heat Transfer and Fluid mechanics is essential. The understanding of Industrial hydraulics and pneumatics is essential for Industrial automation.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understand the working of Engines, pumps & compressors and its maintenance. The working of hydraulics and pneumatics systems.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

The students will be able:

1. To understand working principles of heat transfer, types of section and orthographic view
2. To know the basic knowledge about the I.C. Engines.
3. To know basic knowledge of 3d printing and robotics
4. To know the basics of power transmission devices
5. To understand the working principal of compressor and pumps etc.
6. To understand the properties of fluids and to get introduction to Industrial Hydraulics Conduct all the tests and calculate the values of different properties.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 Play the role of metallurgist in industries**	**PSO2 Awareness about safety protocols**	**PSO3 Develop sensitivity among the students about the environmental hazards**
CO1 - To understand working principles of heat transfer, Types of section and orthographic view	2	1	2	3	1	1	1	2	2	3

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 Play the role of metallurgist in industries**	**PSO2 Awareness about safety protocols**	**PSO3 Develop sensitivity among the students about the environmental hazards**
CO2 - To know the basic knowledge about the I.C. Engines.	2	1	2	1	1	1	3	2	2	2
CO3 - To know basic knowledge of 3d printing and robotics	2	1	2	1	1	1	2	1	2	1
CO4 - To know the basics of power transmission devices	1	2	1	2	1	1	2	2	1	1
CO5 - To understand the working principal of compressor and pumps etc.	2	1	2	2	1	2	1	3	2	1
CO6 - To understand the properties of fluids. To get introduction to Industrial Hydraulics Conduct all the tests and calculate the values of different properties.	1	2	1	3	1	2	1	1	2	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 experiences	**ourse outcome**
1	Advanced Sectional Orthographic View	CO1
2	Types Of Section	CO1
3	I.C. Engine	CO2
4	Heat Transfer	CO1
5	3d printing & Robotics	CO3
6	Power transmission devices	CO4
7	Pumps and Compressors	CO5
8	Introduction to Industrial Hydraulics and Pneumatics	CO6

II) Theory

Section I

Sr. No.	Topics Subtopics	Teaching (Hours)	Marks
CO1 : To understand working principles of heat transfer, Types of section and orthographic view			
1	**Advance Sectional Orthographic view** Crankshaft, Engine body, camshaft, flanged coupling, pump body.	**06**	**08**
CO1 : To understand working principles of heat transfer, Types of section and orthographic view			
2	**Types Of Sections** Conventional, revolved, removed, partial, offset, flywheel, pulley, gear.	**02**	**04**
CO2 : To know the basic knowledge about the I.C. Engines			
3	**I.C. Engines** Classification, Different parts, Materials used, Working principle of two stroke, four stroke, Petrol, Diesel engines and difference between them.	**06**	**10**
CO1 : To understand working principles of heat transfer, Types of section and orthographic view			
4	**Heat Transfer** Modes of heat transfer, Calculations of heat transfer for given condition, Conduction, Convection and Radiation, Insulation, Types of insulation, Applications related to Metallurgy, Concept of Black body. (Simple Numericals)	**08**	**12**

Section –II

Sr. No.	Topics Subtopics	Teaching (Hours)	Marks
CO3 : To know basic knowledge of 3d printing and robotics			
5	**3D Printing & Robotics** Introduction, explain history of 3d printing, Recognize what a 3d printer looks like Describe where 3d printing are used in society, Explain benefits of using 3d printer to make products Explain basic concept of how a 3d printer works (operations) **Robotics** Introduction to robotics Designing, construction, operation Applications of robots	**04**	**08**

CO4 : To know the basics of power transmission devices			
6	**Power Transmission Device** Rope drive, Pulley Belt Transmission & types, Chain drive, Gear drive, Advantages, Disadvantages & applications.	**04**	**10**
CO 5 : To understand the working principal of compressor and pumps etc.			
7	**Pumps and Compressors** Classification, Construction and Working, applications.	**05**	**06**
CO6 : To understand the properties of fluids. To get introduction to Industrial Hydraulics Conduct all the tests and calculate the values of different properties.			
8	**Introduction to Industrial Hydraulics and Pneumatics**. Basic components of hydraulic & pneumatic system. Control elements for pressure, flow and direction. Hydraulic power pack, FRL unit, Meter in and Meter out circuits, Sensors, Actuators, Applications.	**10**	**12**

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

G. List of Assignments under SLA

Sr .no	List of assignments	Hours allotted
1	**Advance Sectional Orthographic view – sheet 1** Sectional view – sheet 2	03
2	Demonstration of I.C. Engine.	02
3	Calculation of heat transfer	02
4	Demonstration of Pumps – Centrifugal & Reciprocating	03
5	Working of 3d printing and robotics	02
6	Components of hydraulic & pneumatic system. Control elements for pressure, flow and direction.	03

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	Advance Sectional Orthographic view	04	04	--	08	CO1
I / 2	Types Of Sections	02	02	--	04	CO1
I / 3	I.C. Engines	04	04	02	10	CO2
I / 4	Heat Transfer	04	04	04	12	CO1
II /5	3D Printing & Robotics	04	02	02	08	CO3
II /6	Power Transmission Device	02	04	04	10	CO4
II / 7	Pumps and Compressors	02	02	02	06	CO5
II / 8	Introduction to Industrial Hydraulics and Pneumatics.	04	04	04	12	CO6

	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**

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, Demonstrative charts, Industrial Visits, Experimental work, Models.

L. Reference Books:

Sr No	**Name of Book**	**Author**	**Publisher**
1	Hydraulic Machinery	Khurmi	S.Chand Co Ltd.,New Delhi
2	Heat Engine Patel Karmachandani	Patel Karmachanda	Ahcarya Publication

3	Hydraulic Machinery	Jagdish Lal	Metropolitan Publishers
4	Heat Transfer	S.P.Sukhatme	Tata Mc Graw Hill
5	Industrial Hydraulics and Pneumatics	Pipenger	Tata Mc Graw Hill

M. Learning Website & Software

1. **https://www.britannica.com/technology/internal-combustion-engine**
2. **https://levelupengines.com/ic-engine/**
3. **https://www.explainthatstuff.com/pumpcompressor.html**
4. **https://sciencenotes.org/heat-transfer-conduction-convection-radiation/**
5. **https://www.powermotiontech.com/technologies/other-technologies/article/21884114/chapter-5-pneumatic-and-hydraulic-systems**
6. **ULTIMAKER CURA SOFTWARE**

***

COURSE ID :
COURSE NAME : Auto CAD & 3-D Modelling
COURSE CODE : MTH 308
COURSE ABBREVIATION : HATM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	01	03
	Tutorial Learning	--	
	Laboratory Learning	04	
	SLH-Self Learning	01	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
--	--	--	--	--	--	--	50	20	25	10	75

(Total IKS Hrs for Sem. : Nil)

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 Note : (TNR 11 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

Technically Auto CAD AND 3D modelling refers to objects that are constructed on 3 planes (X,Y,Z). The process of creating 2 7 3 dimensional (3D) computer graphics can be divided into 3 basic phases - 3D modeling, 3D animation & 3D rendering. 3D models means solid model is usually originated on the computer by engineer using some kind of solid modeling softwares.

Today 2 D & 3D models are used in wide variety of engineering fields. Three dimensional computer graphics are widely used for product design, assembly design etc. As a diploma engineer he should have the knowledge of solid modeling software to visualize the machine components & assembly like cars, machine tools and earth movers etc.

Use modelling software to understand representation of any 2 & 3 dimensional object and to visualize the machine components, assembly in software.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understand the basics of software and reading of drawing accordingly

E. COURSE LEVEL LEARNING OUTCOMES (COS)

CO 1 - Drawing 2D model using toolbar.
CO 2 -Creating objects – 2 D.
CO 3 - Apply *editing commands* dimensions, tolerances and generate tolerances.
CO 4 - Drawing Templates.
CO 5 - Use and apply 3D Solid model input format

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 Play the role of metallurgist in industries**	**PSO2 Awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO1 - Drawing 2D model using toolbar.	2	-	1	1	1	1	1	1	1	1
CO2 - Creating objects – 2 D	1	1	3	1	1	-	2	1	1	-
CO3 - Apply editing Commands dimensions tolerances and generate tolerances.	1	1	2	1	1	2	1	1	-	-
CO4 - Drawing Templates	3	2	1	1	2	1	1	1	-	-
CO5 - Use and apply 3D Solid model input format	1	2	1	2	1	1	1	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 experiences	Course outcome
1	Creation 2 D sketches using drawing commands	CO1
2	Creation of at least 2 models	CO2
3	Creation of at least 3 Objects	CO2
4	Using editing commands and dimensioning system	CO3
5	Generation of orthographic projections front view, top view, side view, isometric view.	CO4
6	Creating templates – mirror , hatching, rotate	CO4
7	Creation 3 D sketches using drawing commands	CO5

II) Theory

Sr. no	**Topics** **Subtopics**	**Teaching (Hours)**	**Marks**
CO1 : Draw 2D model using toolbar.			
1	**Introduction to Auto CAD** Getting Started with AutoCAD, Basic Drawing & Editing Commands - Lines Circles Rectangles , Projects - Creating a Simple Drawing - Creating Simple Drawings Using Object Snap Tracking to extrapolate a projected top view Using Modify tools to arrange an office layout	10	08
CO2 : Create objects			
2	**Drawing of objects** Advanced Object Types Polylines Arcs Polygons Ellipses Drawing Precision in AutoCAD Polar and Ortho Tracking Entering Coordinates and Angles Object Snaps and Tracking	12	10
CO3 - *Apply editing commands*			
3	**Editing commands** Making Changes in Your Drawing Move Copy Rotate Mirror Scale Using the reference option with the Scale Tool Advanced Editing Commands Trim and Extend Fillet and Chamfer Polyline Edit and Spline Offset and Explode Dimensioning Using Dimensioning Tools Dimensioning in a Layout Tab vs. the Model Tab Using Dimension Styles Editing Dimensions	10	14
CO4 ***:*** *Drawing Templates*			

4	**Drawing Templates** Using Template Files (.dwt) to Make New Drawing Exploring what Settings and Elements are saved with Templates. Text The Multiline Text Tool The Single Line Text Tool Editing Text	14	08
CO5 : Use and apply 3D Solid model input format			
5	**Introduction To 3d Drawings** Types Of 3d Models The Convention To Autocad 3d Coordinate Systems In Autocad 3d Viewing A 3d Model Creating Wireframe Models Creating Surface Models Modelling Solid Objects Editing 3d Objects Generating Drawing Views Of Solid Models Animations For 3d Objects	14	10
	Total	**60**	**50**

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

G. List of Assignments under SLA

Sr .no	List of assignments	Hours allotted
1	Introduction to AutoCad	02
2	Drawing And Editing Commands	02
3	Drawing templates with steps	01
4	Dimensioning systems and its commands	03
5	Drawing templates with steps	04
6	Introduction to 3d	03

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	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**

J. Instructional Methods:

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

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts. Multimedia projection facility shall be used during lecture sessions along with computer facility e.g. laptop, computer, LCD projector to teach this Course for effective learning.

L. Reference Books:

Sr. No.	Author	Title	Publisher / Edition
1	Sham Tickoo	CATIA V5R17 for Designers	Softcover, Cadcim Technologies
2	Sham Tickoo	Pro/Engineer Wildfire for Designers	Softcover, Cadcim Technologies
3	Sham Tickoo	SolidWorks For Designers Release 2006	Softcover, Cadcim Technologies
4	Sham Tickoo	Autodesk Inventor for Designers: Release 10	Softcover, Cadcim Technologies
5	Sham Tickoo, Deepak Maini	NX 4 for Designers	Softcover, Cadcim Technologies
6	Sham Tickoo, Deepak Maini	Solid Edge V19 for Designers	Softcover, Cadcim Technologies
7	--	Various advance 3d modelling software manuals	--

M. Learning Website & Software

1. http://catiatutor.com/
2. http://www.cadenv.com/Tutorials/catia_tutorials/Catia.htm
3. http://www.frotime.com/
4. http://www.proetutorials.com/
5. http://www.solidworks.com/sw/resources/solidworks-tutorials.htm
6. http://www.solidengineering.co.nz/solidworks_free_tutorials.htm
7. www.solidedgetutorials.com/
8. http://appsci.queensu.ca/courses/APSC161/SETutorials.php
9. http://homepages.cae.wisc.edu/~me232/ug_tutorials/ug_tutorials.htm
10. http://www.jqoc.com/soft/Unigraphics-Tutorial/
11. Auto cad software – latest version

***

Programme :- **ALL**
Semester : **THIRD**
Course Title : **ESSENCE OF INDIAN CONSTITUTION**
Course Code :- **CCH205**

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.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		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	
CCH205	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 4 Hrs

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

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

CO1 - List salient features and characteristics of the constitution of India.

CO2 - Follow fundamental rights and duties as responsible citizen and engineer of the country.
CO3 - Analyze major constitutional amendments in the constitution.
CO4 - Follow procedure to cast vote using voter-id.
CO5-List the roles and responsibilities of State Election Commission towards peoples in the state.
CO-6 List Judiciary provisions for the peoples in general

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

SECTION-I		
Sr. No.	**Topics / Sub-topics**	**Lectures (Hours)**
1	**CCH 205. 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**
2	**CCH 205. 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 Teritories and their limitations.	**3**
3	**CCH 205.3** 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		
4	**CCH 205.4** Local Administration:-Their roles and responsibilities 4.1 District Administration. 4.2 Municipal Corporation. 4.3 Zilla Panchayat 4.4 Taluka (Tahasil) Administration .	**2**
5	**CCH 205. 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**
6	**CCH 205. 6.** Introduction to Judiciary Provisions :- 1.1 Introduction 1.2 Different courts. 1.3 Government legal advisor-provisions. **1.4** Limitations of courts and co-ordination with Home department.	**3**

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : N.A.

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

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

[Assignments are to be provided by the course teacher in line with the targeted COs. A1. Prepare an essay on .Constitution of India . A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. 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 Resrvation 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.
i. National (Art 352) & State Emergencies (Art 356) declared in India.
ii. Seven fundamental rights.
iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Constitution and Preamble	CO1	4	-	-	-	-
2	II	Fundamental Rights and Directive Principles	CO2	4	-	-	-	-
3	III	Governance and Amendments	CO3	4	-	-	-	-
4	IV	Electoral Literacy and Voter's Education	CO4	3	-	-	-	-
Grand Total				**15**				

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning): Suggested Proformas are to be used for ASSESSMENT.

Assignment, Self-learning and Terms work Seminar/Presentation

Summative Assessment (Assessment of Learning):- Suggested Proformas are to be used for ASSESSMENT

XI. SUGGESTED COS - POS MATRIX FORM

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-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	-	-	2	-	-			
CO2	1	-	-	-	2	-	-			
CO3	1	2	-	-	2	-	1			
CO4	-	-	-	1	-	-	-			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P.M.Bakshi	The Constitution of India	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2	D.D.Basu	Introduction to Indian Constitution	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3	B. K. Sharma	Introduction to Constitution of India	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197
4	MORE READS :	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.	Extra Read
5	B.L. Fadia	The Constitution of India	Sahitya Bhawan,Agra, 2017, ISBN:8193413768

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.legislative.gov.in/constitution-of-india	Constitution overview
2	https://en.wikipedia.org/wiki/Constitution_of_India	Parts of constitution
3	https://www.india.gov.in/my-government/constitution-india	Constitution overview
4	https://www.toppr.com/guides/civics/the-indian-constitution/ the-constitution-of-india/	Fundamental rights and duties
5	https://main.sci.gov.in/constitution	Directive principles
6	https://legalaffairs.gov.in/sites/default/files/chapter%203. pdf	Parts of constitution
7	https://www.concourt.am/armenian/legal_resources/world_const itutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-c onstitution	Parts of constitution

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	**: MT**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Fourth**	**Scheme**	**: H**

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme												
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	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	Testing of Materials	HTM	DSC	3	MTH309	2	4	--	2	2	8	4	3	30	70	100	40	--	--	25@	10	25	10	150
2	Steel Making	HSM	DSC	3	MTH310	2	4	--	--	2	6	3	3	30	70	100	40	--	--	--	--	25	10	125
3	Physical Metallurgy-II	HPHM-II	DSC	3	MTH312	--	4	--	2	2	8	4	3	30	70	100	40	--	--	25#	10	25	10	150
4	Foundry Technology-II	HFT- II	DSC	3	MTH313	--	4	--	2	2	8	4	3	30	70	100	40	--	--	25#	10	25	10	150
5	Electrical & Electronics Engg.	HEEE	AEC	3	MTH311	--	4	--	2	--	6	3	3	30	70	100	40	25	10	--	--	--	--	125
6	Environmental Edu. & Sustainability	HEES	VEC	2	CCH206	2	2	--	--	2	4	2	1.5	30	70*#	100	40	--	--	--	--	25	10	125
Total						10	22		08	10	40	20				600		25		75		125		825

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

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) : 04, Discipline Specific Elective (DSE) : 00, Value Education Course (VEC) : 01, Intern./Apprenti./Project./Community (INP) : 00,Ability Enhancement Course (AEC) : 01, Skill Enhancement Course (SEC) : 00, Generic Elective (GE) : 00

COURSE ID :
COURSE NAME : TESTING OF MATERIALS
COURSE CODE : MTH309
COURSE ABBREVIATION : HTM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	04
	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				150
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	30	70	100	40	--	--	25@	10	25	10	

(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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE

Engineers use different materials for various engineering purposes. These materials are subjected to various kinds of forces and stresses during service and often involve the risk of breaking in service and in that situation they cannot be welded or molded instantly. It may take long time to further rework on the same to give them shape or they may not be re-shaped at all. Hence, it is necessary to make the material and objects strong enough. To ensure this, these solid objects require various types of destructive and non-destructive testing during the manufacturing process so that the risk factor is reduced, facilitating durability and long lasting capacity.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Carry out Destructive and Non-destructive tests on various materials in industries.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

1. Conduct tensile test on different materials.
2. Select the appropriate hardness tester for given specimen.
3. Conduct Izod and Charpy impact tests.
4. Recommend the methods to improve fatigue life.
5. Perform the creep test.
6. Select the suitable non-destructive testing method for given specimen.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Conduct tensile test on different materials	3	--	--	3	1	2	--	3	1	1
CO-2 : Select the appropriate hardness tester for given specimen	3	1	1	1	--	2	1	3	1	1
CO-3 : Conduct Izod and Charpy impact tests	3	--	--	3	1	2	--	3	1	1
CO-4 : Recommend the methods to improve fatigue life	3	2	3	3	1	2	1	3	1	1
CO-5 : Perform the creep test	3	--	--	3	1	2	--	3	1	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-6 : Select the suitable non-destructive testing method for given specimen	3	1	1	1	--	2	1	3	1	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 experiences	CO
1	To perform tensile test on mild steel.	1
2	To draw stress-strain curve. To interpret the curve with respect to applicability of materials.	1
3	To perform hardness test on sample using Rockwell Hardness Tester.	2
4	To perform hardness test on sample using Brinell Hardness Tester.	2
5	To perform impact tests on mild steel specimen.	3
6	To perform fatigue tests on mild steel specimen.	4
7	To carry out dye penetrant test.	6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Conduct tensile test on different materials			
	Introduction & Mechanical Properties of Metals 1.1 Introduction of mechanical testing and its objective. 1.2 A brief introduction to bonding arrangement in		

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
1	materials and especially in metals and alloys i.e. metallic bond. 1.3 Deformation of metals under various loading conditions i.e. tensile, compressive and shear. 1.4 Tensile Test : Significance, Universal Testing Machine, Process, Introduction of high temperature tensile test and low temperature tensile test. 1.5 Elastic and plastic deformation, stress, strain, elasticity, plasticity, yield stress, ultimate tensile stress, toughness, resilience, ductility, malleability. 1.6 Stress - Strain curves, percentage elongation and reduction in area, proof stress, Hook's law, Young's modulus. 1.7 Bend and torsion tests. 1.8 Types of fracture. IKS – Fracture toughness	10	12
CO2: Select the appropriate hardness tester for given specimen			
2	**Hardness Tests** 2.1 Significance and concept of hardness test. 2.2 Methods of hardness test : Indentation, scratch and rebound. 2.3 Types of hardness tests: i. Brinell hardness test, ii. Poldi hardness test, iii. Vickers hardness test, iv. Rockwell hardness test, v. Rockwell Superficial hardness test, vi. Micro hardness testing, vii. Shore Scleroscope, viii. Durometers, ix. Moh's scale of hardness. IKS – Tests on non-metals	12	14
CO3: Conduct Izod and Charpy impact tests			
3	**Impact Tests** 3.1 Significance of impact test, ductile-brittle transition temperature. 3.2 Izod and Charpy impact tests : Their specimen details, mounting of specimens, procedure. 3.3 Effect of variables: Velocity, specimen size, temperature, notch effect.	08	08

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom

			learning evaluation Marks
CO4 : Recommend the methods to improve fatigue life			
4	**Fatigue Test** 4.1 Significance and concept of fatigue. 4.2 Fatigue test – Procedure. 4.3 Bauschinger effect, fracture appearance. 4.4 Factors affecting fatigue life. 4.5 Methods improving fatigue life.	08	10
CO5 : Perform the creep test.			
5	**Creep Test** 5.1 Significance and concept of creep. 5.2 Creep Test, creep curve, effect of temperature on creep test, equi-cohesive temperature. 5.3 Creep fracture. 5.4 Requirements for creep resistant materials.	06	08
CO6 : Select the suitable non-destructive testing method for given specimen			
6	**Non-Destructive Testing** 6.1 Need for non-destructive tests, concept of nondestructive tests. 6.2 Comparison between destructive and non-destructive tests. 6.3 Principle, procedure, advantages and limitations of following non-destructive tests: i. Visual Inspection, ii. Leakage testing, iii. Dye Penetrant test, iv. Magnetic Particle Inspection, v. Ultrasonic test : Pulse-echo method, Transmission method. vi. Radiography : X-ray and γ-ray vii. Eddy Current test.	16	18

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

G. List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Draw stress-strain curve for mild steel. Explain it.	2
2	Write down standard bend test and torsion tests.	4
3	Collect data about standard working procedure & calibration of any one hardness test.	2
4	Draw different specimens of Izod and Charpy impact tests. Show specimen arrangement of both tests.	4
5	Collect data about effect of various variables on impact test.	2
6	Collect details of factors affecting fatigue life.	2
7	Study the creep curve of creep test.	2
8	Collect data about the importance of visual inspection and leakage test.	4

9	Study the procedure of Pulse-echo method and Transmission method of ultrasonic test.	4
10	Collect the information of interpretation of X-ray film.	4

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	Mechanical Properties of Metals	06	04	02	12	1
I / 2	Hardness Tests	04	04	06	14	2
I / 3	Impact Tests	02	02	04	08	3
II /4	Fatigue Test	04	04	02	10	4
II /5	Creep Test	02	04	02	08	5
II / 6	Non-Destructive Testing	04	06	08	18	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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.

3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Material Science And Metallurgy	Dr. V.D.Kodgire	Everest Publishing House
2	Testing of Metallic Materials	A.V.K. Suryanarayana	Printice-Hall of India Pvt. Ltd.

M. Learning Website & Software

1. https://en.wikipedia.org/wiki/Mechanical_testing
2. https://www.vssut.ac.in/lecture_notes/lecture1497881261.pdf
3. https://www.youtube.com/watch?v=uQOs_tgHZsI
4. https://www.youtube.com/watch?v=bXV6ZimFzws (Hardness Test)
5. https://www.youtube.com/watch?v=D8U4G5kcpcM&t=5s (Tensile Test)
6. https://www.youtube.com/watch?v=tpGhqQvftAo (Impact Test)
7. https://www.youtube.com/watch?v=LhUclxBUV_E&t=592s (Fatigue Test)
8. https://www.youtube.com/watch?v=FztoEU87B90&t=30s (Creep Test)
9. https://www.youtube.com/watch?v=tlE3eK0g6vU&t=3s (Non-destructive Tests)

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COURSE ID :
COURSE NAME : STEEL MAKING
COURSE CODE : MTH310
COURSE ABBREVIATION : HSM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	03
	Tutorial Learning	--	
	Laboratory Learning	--	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	--	--	--	--	25	10	125

(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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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

Steel is one of the most important material. Applications of steel are much more. Use of steel is much more for construction as well as manufacturing industries. Because of this, knowledge of various methods of steel making is very much essential for metallurgists. In this course, the emphasis is given on the principles of steelmaking and different processes of steel making.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understand the principle of steel making and monitor this in various steel making processes.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Identify the necessity of conversion of pig iron into steel.
2. Use the principles of steel making to obtain quality steel.
3. Recommend suitable method of production for different types of steels.
4. Identify the importance of oxygen addition in steel production.
5. Recognize the role of secondary steel making processes.
6. Identify different components of various continuous casting machines.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Identify the necessity of conversion of pig iron into steel	3	1	1	--	1	1	2	2	2	2
CO-2 : Use the principles of steel making to obtain quality steel	3	--	1	2	2	1	2	3	2	2
CO-3 : Recommend suitable method of production for different types of steels	3	--	2	--	--	1	2	3	2	2

CO-4 : Identify the importance of oxygen addition in steel production	3	--	--	--	--	1	1	1	1	--
CO-5 : Recognize the role of secondary steel making processes	3	2	2	--	1	1	2	3	--	--
CO-6 : Identify different components of various continuous casting machines	3	--	--	--	--	1	--	2	1	1

F. CONTENT:-

I) Practical exercises – Not Application

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1 : Identify the necessity of conversion of pig iron into steel			
1	**Introduction :** 1.1 History of steel making. 1.2 Classification of steels. 1.3 Necessity of conversion of pig iron into steel. 1.4 Raw materials for steel making: a. Sources of metallic iron, b. Oxidizing agent, c. Fluxes, d. Sources of heat, e. Deoxidisers and alloying additions, f. Furnace Refractories. IKS : Mini blast furnace, Present status of iron and steel industries in India.	10	10
CO2 : Use the principles of steel making to obtain quality steel			
2	**Principles of Steel Making :** 2.1 Principles of steel making: a. Carbon reaction, b. Phosphorous reaction, c. Silicon reaction, d. Manganese reactions,	6	8

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	e. Sulphur reaction, f. De-oxidation of steel. 2.2 Types of steel making processes- Acid and basic steel making. 2.3 Efficiency of steel making processes.		
CO3 : Recommend suitable method of production for different types of steels			
3	**Steel Making Processes :** 3.1 Bessemer process - Principle, constructional details, process details, merits and demerits, characteristics of steel produced. 3.2 Open - hearth process - Principle, constructional details, process details, merits and demerits, characteristics of steel produced, twin hearth furnace. 3.3 Electric steel making processes: a. Electric arc furnace: Principle, constructional details, charge materials, process detail, outline, merits and demerits, characteristics of steel produced. b. Induction furnace: Principles, charge materials, merits and demerits of process, characteristics of steel produced.	14	16

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4 : Identify the importance of oxygen addition in steel production			
4	**Oxygen Steel Making :** 4.1 L.D. Converter - Principle, constructional details, process details, outline, merits and demerits, characteristics of steel produced. 4.2 Kaldo process - Principle, process, merits and demerits, characteristics of steel produced. 4.3 Rotor Process - Principle, process, merits and demerits, characteristics of steel produced. 4.4 OBM Process - Principle, process, merits and demerits, characteristics of steel produced. 4.5 Plant layout of primary steel making	10	12
CO5: Recognize the role of secondary steel making processes			
	Secondary Steel Making : 5.1 Introduction and merits of secondary steel making process. 5.2 Decarburization techniques - AOD, VOD, CLU. 5.3 VAR and ESR processes.		

5	5.4 Ladle furnace. 5.5 Vacuum Treatment of Steel – Functions, principles, Degassing techniques: a. Ladle degassing b. Stream degassing c. Recirculation degassing - R.H. and D.H. degassing processes. 5.6 Plant layout of secondary steel making.	14	16
CO6 : Identify different components of various continuous casting machines			
6	**Continuous Casting of Steel :** 6.1 Principle of continuous casting process. 6.2 Essential details of continuous casting machine. 6.3 Types of continuous casting machines : a. Vertical type, b. Vertical-mould horizontal-discharge type, c. Curved mould. 6.4 Merits, Demerits.	6	8

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

G. List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Raw materials and their functions in steel making	2
2	Principle of steel making with reactions	2
3	Construction and working of Bessemer Process with neat sketch	2
4	Construction and working of Open Hearth Process with neat sketch	2
5	Construction and working of Electric Arc Furnace and Induction Furnace with diagrams	4
6	Working of following processes with neat sketch : (i) L.D. Converter, (ii) Kaldo process, (iii) Rotor Process, (iv) OBM Process	4
7	1. Merits of secondary steel making process 2. Working of following processes with neat sketch : (i) AOD, VOD and CLU. (ii) VAR and ESR processes. (ii) Ladle furnace. (iii) Ladle degassing, Stream degassing, R.H. and D.H. degassing processes.	8
8	Draw plant layout of (i) Primary Steel Making Plant (ii) Secondary Steel Making Plant	2
9	1. Principle of continuous casting process. 2. Working of following continuous casting machines with neat sketch : a. Vertical type,	4

	b. Vertical-mould horizontal-discharge type, c. Curved mould type	

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	6	2	2	10	1
I / 2	Principles of Steel Making	2	4	2	08	2
I / 3	Steel Making Processes	4	6	6	16	3
II /4	Oxygen Steel Making	2	6	4	12	4
II /5	Secondary Steel Making	2	6	8	16	5
II / 6	Continuous Casting of Steel	2	4	2	08	6
	Total Marks				70	

I. Assessment Criteria

i) Formative Assessment of Practical :- Not Application

ii) Summative Assessment of Practical : 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, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	An Introduction to Modern Iron Making	Dr. R.H. Tupkary, V.R. Tupkary.	Khanna Publication,
2	An Introduction to Modern Steel Making	Dr. R.H. Tupkary, V.R. Tupkary.	Khanna Publication

M. Learning Website & Software

1. https://en.wikipedia.org/wiki/Steelmaking
2. https://www.steel.org/steel-technology/steel-production/
3. https://www.sciencedirect.com/topics/engineering/steelmaking-process
4. https://www.steelconstruction.info/Steel_manufacture
5. https://www.sciencedirect.com/topics/engineering/continuous-casting

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COURSE ID :
COURSE NAME : PHYSICAL METALLURGY - II
COURSE CODE : MTH312
COURSE ABBREVIATION : HPHM-II

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	4
	Tutorial Learning	--	
	Laboratory Learning	2	
	SLH-Self Learning	2	
	NLH- Notional Learning	8	

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				150
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	30	70	100	40	--	--	25#	10	25	10	

(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 Note : (TNR 11 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)

C. i) RATIONALE

Heat treatment is an exclusive area of Metallurgist as it requires through understanding of phase transformations, products of transformations, use of TTT curves and critical temperatures as well as critical compositions. The purpose of each heat treatment, its process and its applications need to be properly studied for providing proper solution to the property requirements.

Majority of the critical components have requirement for enhanced properties developed by heat treatments. Designing heat treatment cycle with reference to the particular grade of the steel is tricky. After sufficient experience under qualified guidance one can earn the proficiency as a successful heat treater.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Importance of heat treatment cycle is not understood unless necessary knowledge of various microstructures is acquired. In commercial practices use of National and International standards for controlling the quality does exist. So, implementation of these standards requires well qualified metallurgists in heat treatment shops. There is no replacement to these job roles with other options.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Competency, course outcomes and programme outcomes/programme specific outcomes

1. Identify the products of phase transformation and design the heat treatment cycles accordingly.
2. Use annealing and normalizing heat treatment to obtain desired properties in steels.
3. Undertake hardening treatment by selecting cooling rate & quenching media.
4. Use hardenability to identify cooling rates necessary to achieve hardening of steels.
5. Use tempering treatments to achieve desired properties such as eliminate thermal stresses, increase toughness.
6. Use case hardening and surface hardening treatments to increase the hardness and wear resistance of the surface.

(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 Engg Tools, Experimentation and Testing	PO 5 Society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 The role of metall urgist in ind.	PSO2 To create awareness about safety protocols	PSO3 Develop sensitivity about the environmental hazards
CO-1 : Identify the products of phase	3	3	2	3	2	1	2	3	1	1

transformation and design the heat treatment cycles accordingly										
CO-2: Use annealing and normalizing heat treatment to obtain desired properties in steels	3	3	3	3	1	1	3	3	2	1
CO-3: Undertake hardening treatment by selecting cooling rate & Quenching media.	3	3	3	2	2	1	3	3	2	3
CO-4: Use hardenability to identify cooling rates necessary to achieve hardening of steels	3	3	3	3	2	2	3	3	2	3
CO-5: Use tempering treatments to achieve desired properties such as eliminate thermal stresses, increase toughness	3	3	3	3	2	2	3	3	2	2
CO6: Use case hardening and surface hardening treatments to increase the hardness and wear resistance of the surface	3	3	2	3	2	3	2	2	2	3

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 experiences	CO
1	Understand the nature of various microstructures such as pearlite, bainite, martensite etc.	1
2	Compare the microstructures of steels after annealing and normalizing.	2
3	Undertake hardening treatment of steels after referring to the CCR of that steel.	3
4	Understand the changes in microstructures in response to change in tempering temperatures.	3
5	Familiarize with other heat treatments such as martempering, austempring, ausforming.	4
6	Know the case hardening treatments such as carburizing, nitriding, carbonitriding with their applications.	5
7	Understand the characteristics of surface hardening treatments such as Induction hardening and flame hardening.	6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: 1 Identify the products of phase transformation and design the heat treatment cycles accordingly.			
1	**Transformations of steels on heating:** Isothermal cooling of steel and construction of TTT diagram for hypoeutectoid, eutectoid and hypereutectoid steels. Continuous cooling of steel CCT diagram. Effect of cooling rates on properties and microstructure of steels Mechanism and kinetics of transformation of austenite to pearlite, austenite to martensite, upon cooling CCR, volumetric changes. significance of Ms and Mf. Characteristics of Martensite transformation. Effect of carbon and alloying elements	12	14
CO2: Use annealing and normalizing heat treatment to obtain desired properties in steels			
2	**Annealing and Normalizing** Objectives of annealing. Mechanism of annealing treatment, Temperature range for annealing. Classification of annealing based on temperature and based on phase transformation. Types of Annealing such as full annealing, isothermal annealing, Partial annealing, Homogenizing (Diffusion annealing), Recrystallization annealing, Process annealing, Spherodizing, Box annealing, etc. Normalizing, Objectives and temperature range of normalizing Comparison with annealing.	10	12
CO3: Undertake hardening treatment by selecting cooling rate & Quenching media.			
3	**Hardening heat treatment** Quenching Media _Mechanism of heat removal. Use of various quenching media Polymer quenching. Common quenching media. Hardening Process Preparation and care to be taken in hardening. Methods of quenching Use of furnace atmospheres.	08	08

Section –II

Sr. no.	Topics/Subtopics	Learning	Classroo

		(Hours)	m learning evaluation Marks
CO4 : Use hardenability to identify cooling rates necessary to achieve hardening of steels.			
4	**Hardenability of steel** Concept of Hardenability, Hardness penetration curve (U curves), Severity of quench (H), Ideal critical diameter. Methods of determination of Hardenability-Grossman critical diameter method, Jominy end quench test, Fracture test and chemical composition test , Use of hardenability curves in industry. Factors affecting hardenability.	08	12
CO5 : Use tempering treatments to achieve desired properties such as eliminate thermal stresses ,increase toughness etc**.**			
5	**Tempering Of Steel:** Objectives of tempering –Structural changes during tempering, Classification of tempering, Effect of tempering temperature on mechanical properties. Temper embrittlement, Secondary hardness, Self tempering	08	08
CO6: Use case hardening and surface hardening treatments to increase the hardness and wear resistance of the surface.			
6	**Case and Surface Hardening Of Steel :** **Case Hardening :** a) Carburising – pack, gas and liquid carburizing. H. T. after carburizing. b) Nitriding – Tufftriding c) Cyaniding–Carbonitriding Diffusion metallizing, Plasma Nitriding Process, Advantage, Limitation & Application. **Surface Hardening of Steels And C.I. -** Process, Advantage, Limitation & Application of a) Induction hardening b) Flame hardening c) Electrolytic bath hardening d) Laser hardening.	14	16

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

G : List of Assignments under SLA

1) Check the microstructures of Pearlite, Bainite and Martensite under the microscope to see its morphologies.
2) Observe the difference between annealed and normalized microstructures of the same steel.
3) Perform the hardening heat treatment for En8 steel sample and check the hardness before and after the heat treatment.

4) Analyze the change in the microstructures of same grade of steel after low, medium, and high temp tempering.
5) Perform Jominy end quench test and plot the graph to understand the concept of hardenability.
6) Check the microstructure of carburized gear to observe the difference in the case and core.
7) Perform flame hardening of En 8 steel and check the hardness of the surface and core.

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	Transformations of steels on heating	06	04	04	14	1
I / 2	Annealing and Normalizing	04	04	04	12	2
I / 3	Hardening heat treatment	04	02	02	08	3
II /4	Hardenability of steel	04	06	02	12	4
II /5	Tempering Of Steel	02	04	02	08	5
II / 6	Case and Surface Hardening Of Steel	06	04	06	16	6
	Total Marks				70	

I :-Assessment Criteria

i) Formative Assessment of Practical : - Not Applicable

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

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, LCD presentations, Demonstrative kits, Demonstrative charts.

L) Reference Books:

S.N.	Name of Book	Author	Publication
1	Material Science and Metallurgy for Engineer	Dr. V.D. Kodgire	Everest Publishing House
2	Physical Metallurgy for Engineers	Donald Clark & Wilber Verney	CBS Publishers
3	Physical Metallurgy Principles	Robert E Reedhill	East West Press
4	Introduction to Physical Metallurgy.	Sidney H Avner	North West Publishing Company

M) Learning Website & Software

1. https://en.wikipedia.org/wiki/Annealing_(materials_science)
2. https://en.wikipedia.org/wiki/Normalization_(statistics)
3. https://en.wikipedia.org/wiki/Tempering_(metallurgy)
4. https://en.wikipedia.org/wiki/Hardening_(metallurgy).

****

COURSE ID :
COURSE NAME : FOUNDRY TECHNOLOGY- II
COURSE CODE : MTH 313
COURSE ABBREVIATION : HFT- II

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	4
	Tutorial Learning	--	
	Laboratory Learning	2	
	SLH-Self Learning	2	
	NLH- Notional Learning	8	

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	150

(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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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

Undertaking job of foundry men requires various skill sets. Casting development is one of the specialized skill sets that include designing gating and risering system for the casting. Each alloy cast in foundry has its own casting characteristics. The equipments and raw materials used for melting and moulding are different.
The production of sound casting is the result of stringent process control parameter. Any deviation in the process parameter will lead to the creation of defect. The skill of identifying the defect, its causes will help in producing sound casting.
Increasing productivity by automation and energy optimization is mandatary for survival of foundries.

ii)INDUSTRY / EMPLOYER EXPECTED OUTCOME

Familiarize with the entire manufacturing process of casting.

E. COURSE LEVEL LEARNING OUTCOMES(COS)

1. Design an elementary gating system for simple casting.
2. Use the principles of risering design to identify hot spots in the casting and develop size and shape of risers to achieve directional solidification by using necessary aids.
3. Control process parameters for producing sound ferrous castings.
4. Control process parameters for producing sound nonferrous castings.
5. Identify defect in casting, find its causes and take appropriate measures to correct it.
6. Understand the areas of automation and energy saving in foundries

Competency, course outcomes and programme outcomes /programme specific 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO1- Design an elementary gating system for simple casting.	3	3	2	2	2	2	2	3	3	2
CO2- Use the principles of risering design to identify hot spots in the casting	3	3	2	3	2	3	2	2	3	3

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO3- Control process parameters for producing sound ferrous castings	3	3	2	3	2	2	2	2	3	3
CO4- Control process parameters for producing sound nonferrous castings	3	3	2	2	3	2	2	2	2	2
CO5- Identify and analyze defects in casting,	3	3	2	2	2	2	2	3	3	2
CO6- Understand the areas of automation and energy saving in foundries.	3	3	2	2	3	2	2	2	3	3

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 experiences	CO
1	Design an elementary gating system for simple casting.	1
2	Locate a hot spot in a given casting drawing and estimate riser size.	2
3	Understand melting practice of Grey Cast Iron casting production.	3
4	Understand of various methods of the S.G. Iron production.	3
5	Understand melting practice of Aluminium alloys.	4
6	Study melting practice of copper alloys.	4
7	Identify casting defect corelating it causes and remedies.	5
8	Understand areas of mechanization, automation and energy saving in foundries.	6

Course Content:

Section I

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
1. Design an elementary gating system for simple casting.			
1	**Flow of Metals and Gating system**. Laws of Fluid Dynamics governing the design of gating system. Equation of Continuity, Bernoulli's theorem, Reynauld's No. Constituents of gating system- Pouring basin, sprue, runner, gates, Gating ratio and Its types. Calculations in designing of gating system. (Pouring time, Sprue, Runner and Ingate areas.) ***IKS** References of the castings found in excavation of ancient sites. Manufacturing of canons during Middle Ages.	10	10
2. Use the principles of risering design to identify hot spots in the casting and develop size and shape of risers to achieve directional solidification by using necessary aids.			
2	**Risering of casting** Main requisites of an effective riser Directional solidification Aids to achieve directional solidification Riser shape and size- Chvorinov's rule, Cain's method, Modulus method, Inscribed circle method Riser location Types of risers	10	10
3. Control process parameters for producing sound ferrous castings			
3	**Ferrous Foundry Practice** Characteristics of Cast Metals Molding practice for Grey C.I., Chill Test, Carbon Equivalent, , Chill test, Effect of Inoculation, IS grades of CI Production of S G Iron casting Various techniques of S.G. iron Production-Sandwich method and convertor method, IS grades of SG Iron, Mg recovery, Austempered Ductile Iron. Production of steel casting Main points of difference between the moulding and the casting of steel and cast iron, Effect of gases on cast steel	10	14
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 Subtopics	Teaching (Hours)	Theory evaluation Marks
4. Control process parameters for producing sound nonferrous castings			
4	**Nonferrous Foundry Practice** Foundry practice for Aluminum alloys. Production of Al and Al alloy casting alloys, Fluxing-Degassing, Modification of Al-Si alloys Metal treatment, Drossing Production of Cu and Cu alloy castings-Moulding, Gating and riser design, Melting, Deoxidation, Drossing, , Oxygen and Hydrogen in Cu melt,	12	12
5. Identify defect in casting, find its causes and take appropriate measures to correct it			
5.	**Casting Defect Analysis** Appearance, causes and remedies for the following casting defects Surface Defects: Metal Penetration, Scab/Swell, Flash/Fin Discontinuity: Misrun/Cold shut, Cold crack, Hot tear, Unfused chaplet Dimensional defect: Mismatch, Warpage/Distortion, Core shift, Wrong dimension Internal defects/Cavities: Shrinkage, Gas porosity, Blow hole, Pin hole, Sand inclusion, Slag inclusion	12	14
6. Understand the areas of automation and energy saving in foundries.			
6	**Modernization and Mechanization in foundries** Advantages of mechanization Areas of mechanization Sand preparation and control, Moulding, Core making Melting, Pouring and Shakeout equipment Material handling Energy saving in foundries Furnace design and construction Furnace power supply Furnace operating practices	06	10
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.			

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

G : List of Assignments under SLA

1. Calculate the sizes of sprue, runner and ingate sizes along with the pouring time.
2. Locate hot spots in a given casting drawing estimate riser size by using any standard method.
3. Get introduced to casting solidification simulation software from a case study.
4. Visit any small-scale grey cast Iron foundry and observe moulding, melting practices.
5. Visit any small-scale S G Iron foundry and monitor sandwitch method of S G iron treatment.
6. Visit any small-scale Aluminium foundry and study fluxing, degassing and refining treatments
7. Visit any medium scale foundry and study various areas of modernization, automation and energy savings

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

Specification Table for setting question paper for semester end theory paper

Sr no	Topic	Distribution of Marks				Course Outcome
		Remember	Understand	Application		
1	Flow of metals and Gating system	04	04	02	10	1
2	Risering of casting	02	04	04	10	2
3	Ferrous foundry practice	04	06	04	14	3
4	Nonferrous practice	04	04	04	12	4
5	Casting defect analysis	04	04	06	14	5
6	Modernization and mechanization in foundries	02	04	04	10	6
	Total	20	26	24	70	

I :-Assessment Criteria

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**

J) Instructional Methods:

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

Text-Books:

Author	Title	Publisher
P.L.Jain	Principles of Foundry Technology	Mcgraw Hill Education(India)
T. V. Ramana Rao	Metal Casting Principle and Practice	New Age International (P) Ltd,Publishers.
Richard W.Heine, Carl R Loper, Philip C Rosenthal	Principle of Metal Casting	Tata MacGraw Hill Publishing Comp.
O .P. Khanna	Foundry Technology	

Reference Books:

Author	Title	Publisher
-	Metal hand book no-6	American Soc. Of Metals

Websites:

1. https://nkn.gov.in/en/services-lt-en/community-services-lt-en/e-foundry-lt-en
2. https://www.indianfoundry.org/
3. https://www.afsinc.org/

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COURSE ID :
COURSE NAME : ELECTRICAL & ELECTRONICS ENGINEERING
COURSE CODE : MTH311
COURSE ABBREVIATION : HEEE

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	03
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	--	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	125
03	30	70	100	40	25	10	--	--	--	--	

(Total IKS Hrs for Sem. : Nil)

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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE: -

The metallurgical technicians working in different fields have to deal with various electrical equipments and circuits. Very often technology is necessary for them to know basic aspects of electrical engineering and operation of various machines with their controls. At the same time, various controls used in process instrumentation are electronic in nature; which are to be understood conceptually. This course thus includes basics of electrical and electronics engineering from the metallurgical point of view.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • Maintain electronic equipment/systems comprising of discrete electronic components.

E. COURSE LEVEL LEARNING OUTCOMES (COs)

MTH 311-01: Make calculations of power and energy using electrical components.
MTH 311-02: Maintain star and delta loads their Power measurement & calculations.
MTH 311-03: Maintain operations of motors & transformers.
MTH311-04: Identify basic electronic components and describe their function.
MTH311-05: Classify various measuring instruments and sensors.
MTH311-06: Compare different number systems and summarize basic logic gates.

Course outcomes and programme outcomes/ programme specific outcomes (CO- PO/PSO) matrix

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

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

	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, Experimenta tion and Testing**	**PO 5 Engineering Practices for society, sustainabilit y and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
Competency: Describe and suggest different devices used for various metallurgical processes										
MTH311-1	1	2	-	2	1	-	1	2	1	-
MTH311-2	1	2	-	2	2	-	1	1	2	-
MTH311-3	1	-	-	2	2	1	1	2	1	-
MTH311-4	2	1	1	1	-	-	-	1	1	-
MTH311-5	2	2	2	1	-	1	-	2	1	-
MTH311-6	-	1	1	1	-	-	1	1	-	-

F) CONTENT:

I) Practical exercises

The following practical exercises shall be conducted in the *Laboratory for Electrical and Electronics developed* by the Institute in practical sessions of batches of about 20- 22 students: (Any 12)

Sr No.	Title of Practical Exercise	Skills / Competencies to be Developed	Course Outcome
1.	Verification of Ohms law	1. Make connections. 2. Measurements of voltage, current. 3. Measure components using digital Multimeter.	MTH311-1
2.	Effect of temperature on resistance of coil.	1. Identify values of changes in temperature & resistances. 2. Calculate coefficient of given of coil	
3.	Varify series & parallel combination of resistances.	1. Make connections. 2. Measurements of resistances voltage, currents. 3. Use of digital Multimeter. 4. Calculate equivalent resistance value.	
4.	Study & observe AC waveform & find Various values of fundamental terms.	1. Make connections. 2. Measure & Calculate RMS, Max. Average, Values, Time period, & Frequency of AC voltage.	MTH311-2
5.	Single phase voltage Current & power measurement.	1. Make connections. 2. Measuremens of single phase voltage, current, power. 3. Use of digital Multimeter.	
6.	Three phase voltage Current & power measurement.	4. Make connections. 5. Measuremens of three phase voltage, current, power. 6. Use of digital Multimeter.	
7.	Three phase Balanced –Unbalanced load conditions.	1. Make connections. 2. Observe Balance & Un-balanced condition.	
8.	Operation of DCMotor- DC Generator	1. Make connections. 2. Observe working, Note readings.	MTH311-3
9.	Operation of Three phase IM - DC Generator	1. Make connections. 2. Observe working, Note readings.	
10.	Operation of Single phase Transformer.	1. Make connections. 2. Observe working, Note readings.	
11.	Observe and identify value of resistor, capacitor and inductor using colour codes and measure using DMM	1. Identify values of components 2. Measure components usning DMM	MTH311-4
12.	Connect PN junction diode in forward and reverse biased condition and draw the characteristics.	3. Make connections. 4. Draw characteristics	
13.	Connect BJT in common emmiter configuration and draw the input – output characteristics.	1. Make connections. 2. Draw characteristics	
14.	Make connections of LED / 7 segment display and study its	1. Identify leads of LED / 7 segment display and make connections of	MTH311-4

	operation.	them.	
15.	Measure various electrical parameters using Digital multi-Meter	1. Use of DMM	**MTH311-5**
16.	Perform pressure measurement using pressure sensor	1. Make connections. 2. Draw operating characteristics	**MTH311-5**
17.	Perform temperature measurement using temperature sensor	1. Make connections. 2. Draw operating characteristics	**MTH311-5**
18.	Perform flow measurement using flow sensor	1. Make connections. 2. Draw operating characteristics	**MTH311-5**
19.	Verify the trith table of OR, AND, NOT gates	1. Identify the IC numbers and logic gates. 2. Make connections. 3. Write truth table.	**MTH311-6**

II) Theory

Section I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MTH 311-01: Make calculations of power and energy using electrical components.			
1.	**Elements of DC electric network;** 1.1 Definition of Electric networks & Ohm's law. 1.2 Basicsof Resistance, Effect of temperature on resistance. 1.3 Equivalent resistance of series, parallel and Combinationofresistance systems. 1.4 Introduction to Electrical work power energy. (Simple numerical problems based on the above.)	**08**	**08**
MTH 311-02Maintain star and delta loads theirPower measuremen& calculations.			

2	**Elements of A C networks& Measuring systems:** 2.1 Concept of sinusoidal waveform. 2.2 Definition of cycle, frequency and periodic time. 2.3 Instantaneous, Max, Average, R.M.S&peakvalue. 2.4 Faraday's Law of Electromagnetic Induction 2.5 Voltage Current, power& power factor. 2.7 Polyphase System- Generations of ThreePhase Voltages. 2.8 Three-Phase 3 wire & 4 wire supply Systems. 2.9 Voltage - Current Relations in Star & Delta loads, Power equations, Balanced-Unbalanced Load conditions. 2.10 Earting – Necessity,their Types i) Plate & ii) Pipe Earthing. Safety measures. 2.11Introduction to Principle of working &Types ofMeasuring Instruments 2.12Use& connections of Ammeter, Voltmeter, Wattmeter,Energy meter, Clip – on – Meter & Digital Multi meter, Megger.	**14**	**14**
MTH 311-03: Maintain operations of motors & transformers.			
3	**Introduction to electrical machines.** (Only Principle of working & Applications) 3.1 DC Motors- Shunt, Series, Compound. 3.2 AC Motors-Concept of Rotating magnetic field, Capacitor start capacitor run, Shaded pole, Universal Motors&Study of Transformers. 3.3 Threephase Induction Motor.	**08**	**12**
		30	**34**

Section II

Sr. No.	Topics	Teaching hours	Marks
MTH 311-4 : Identify basic electronic components and describe their function.			
4.	**Electronics components and photo devices :** 4.1 Resistor, Inductor, Capacitor – definition, symbol, unit of measurement, applications. 4.2 Symbol, Construction, working, characteristics and applications of PN junction diode, BJT (only CE configuration) 4.3 Switches: types, Construction and working of Push Button switch, Relays: Types, Construction and working of Electromagnetic relay, actuators: Types. 4.4 Display devices – LEDs, 7 segment displays, LCD: types, Construction and working of Dynamic scattering display. 4.5 Photo devices –Symbol, Construction, working and characteristics of PN photo diode, Photo transistor, LDR.	**10**	**12**

MTH 311-5: Classify various measuring instruments and sensors.			
5.	**Electronic measuring instruments and transducers :** 5.1 Types of measuring instruments – classification of measuring instruments 5.2 Advantages of electronics instruments 5.3 Block diagram of electronics measuring system and operation 5.4 Transducers – definition and classification 5.5 Temperature sensors: Thermocouples, RTD, Thermistors. 5.6 Pressure sensors: Burdon Tube, Piezo electronic sensor. Diaphragm, Strain Guage 5.7 Flow sensors: Magnetic Induction Flow Sensor, Ultrasonic flow sensor. **5.8** Displacement transducers: LVDT, RVDT	**12**	**14**
MTH 311-6 Compare different number systems and summarize basic logic gates.			
6.	**Digital electronics**: 6.1 Number System-Binary, Octal, Decimal and Hexadecimal, conversions. 6.2 Binary arithmetic – Addition, subtraction using 2's complement 6.3 Logic gates - Symbols, truth tables, logical expression of OR, AND, NOT, NAND, NOR, EX-OR and , EX- NOR gates	**8**	**10**
	Sub-total	**30**	**36**

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

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Elements of DC electric network;	2	2	4	MTH 311-01	08
2	Elements of A C networks & Measuring systems:	4	4	6	MTH 311-02	14
3	Introduction to electrical Machines.	2	4	6	MTH 311-03	12
4	Electronics components and photo devices	2	4	6	MTH 311-04	12
5	Electronic measuring instruments and transducers	4	6	4	MTH 311-05	14

6	Digital electronics:	2	2	6	MTH 311-06	10
	Total Marks					**70**

H :-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: Nil

I) Instructional Methods:

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

J) Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative kits, Demonstrative charts

K) Reference Books:

Sr. No	Name of Book	Author	Publication
1	Principles of Electronics	Mehta, V.K. Mehta, RohitMehta	S.Chand New Delhi, edition-2008ISBN-13: 978-8121927833
2	Electronics Instrumentation	H S Kalsi	McGraw Hill
3	Electronics Circuit and Circuit theory	Robert L.Boylestead	Pearson Education India, ISBN-13978-9332542600
4	A Text book of Applied Electronics	Sedha, R.S.	S.Chand (G/L) & Company Ltd;ISBN-13 978-8121904209
5	Basic Electronics (solid State)	B.L.Theraja	S Chand;ISBN-13 978-8121925556
6	Electronic Principles	Albert P. Malvino, David J.Bates	McGraw Hill; ISBN-13 978-9354602399
7	Basic Electronics and Linear Circuits	N.N Bhargava (Author), D.C. Kulshreshtha (Author), S.C. Gupta (Author)	NITTTR Chandigarh 2nd Edition

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Programme Name/s ALL
Programme :- CE/EE/ME/ET/MT/IF

Semester : Fourth
Course Title : ENVIRONMENTAL EDUCATION AND SUSTAINABILITY
Course Code CCH206

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

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

CO1 - Identify the relevant Environmental issues in specified locality. CO2 - Provide the green solution to the relevant environmental problems. CO3 - Conduct SWOT analysis of biodiversity hotspot
CO4 - Apply the relevant measures to mitigate the environmental pollution.
CO5 - Implement the environmental policies under the relevant legal framework.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		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	
CCH206	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	2	-	-	2	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

[**Use Proforma 1 for Assessment of SLA]**

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	**CCH206.1** 1.1 Explain the need of studying environment and its components. 1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions 1.3 Explain the Concept of 5 R w.r.t. the given situation 1.4 elaborate the relevance of Sustainable Development Goals in managing the climate change 1.5 Explain the concept of zero carbon-footprint with carbon credit	**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 1.5 Zero Carbon footprint for sustainable development, (IKS-Enviornment conservation in vedic and pre-vedic India)	Lecture Using Chalk-Board Presentations
2	**CCH206.2** 2.1 Justify the importance of natural resources in sustainable development 2.2 Explain the need of optimum use of natural resources to maintain the sustainability 2.3 Differentiate between renewable and non-renewable sources of energy 2.4 Suggest the relevant type of energy source as a green solution to environmental issues	**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 2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	Lecture Using Chalk-Board Presentations
3	**CCH206.3** 3.1 Explain the characteristics and functions of ecosystem 3.2 Relate the importance of biodiversity and its loss in the environmental sustainability 3.3 Describe biodiversity assessment initiatives in India 3.4 Conduct the SWOT analysis of the biodiversity hot spot in India 3.5 Explain the need of conservation of biodiversity in the given situation	**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 3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity	Lecture Using Chalk-Board Presentations Video Demonstration

4	**CCH206.4** 4.1 Classify the pollution based on the given criteria 4.2 Justify the need of preserving soil as a resource along with the preservation techniques 4.3 Maintain the quality of water in the given location using relevant preventive measures 4.4 State the significance of controlling the air pollution to maintain its ambient quality norms 4.5 Compare the noise level from different zones of city with justification 4.6 Describe the roles and responsibilities of central and state pollution control board	**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 4.6 Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities	Lecture Using Chalk-Board Presentations
5	CCH206.5 5.1 Explain Constitutional provisions related to environmental protection 5.2 Explain importance of public participation (PPP) in enacting the relevant laws 5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem 5.4 Explain the role of information technology in environment protection	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 5.4 Role of information technology in environment protection and human health	Lecture Using Chalk-Board Presentations Video Demonstrations

VI . LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES: N.A.

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

Assignment

Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution

Draft an article on India's Strategies to progress across the Sustainable Development Goals

Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each source

Conduct the SWOT analysis of biodiversity hotspot in India

Prepare a mind-mapping for the zero carbon footprint process of your field

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

Technical analysis of nearby commercial RO plant.
Comparative study of different filters used in Household water filtration unit
Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainability and cost-benefit
IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion
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

Prepare a report on the working and functions of the PUC Center machines and its relavance in pollution control.
Prepare and analyse a case study on any polluted city of India
Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority
Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers
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
Watch a video related to air pollution in India and present the summary
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.

VIII. ABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

IX . SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Environment and climate change	CO1	6	4	4	4	12
2	II	Sustainability and Renewable Resources	CO2	08	4	4	8	16
3	III	Ecosystem and Biodiversity	CO3	6	4	4	4	12
4	IV	Environmental Pollution	CO4	10	4	8	6	20

5	V	Environmental legislation and sustainable practices	CO5	5	4	4	4	10
Grand Total				**30**	**20**	**24**	**26**	**70**

X . ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject/assignemnt/activities. (60 % weightage to process and 40 % to product)

Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered.

Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject/assignemnt/activities. (60 % weightage to process and 40 % to product)

Assessment of Self Learning :- Based on work done by students as a self learning Activities such as microprojects ,assignments and similar activities using proforma 1 marks of SLA can be calculated.

XI. SUGGESTED COS-POS MATRIX FORM

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-6 Project Management**	**PO-7 Life Long Learning**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	-	1	-	-	3	2	3			
CO2	-	2	2	-	3	2	3			
CO3	-	-	-	-	3	1	2			
CO4	1	-	-	-	3	2	2			
CO5	1	-	2	-	3	2	3			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Y. K. Singh	Environmental Science	New Age International Publishers, 2006, ISBN: 81-224-2330-2
2	Erach Bharucha	Environmental Studies	University Grants Commission, New Delhi
3	Rajagopalan R.	Environmental Studies: From Crisis to Cure.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	Shashi Chawla	A text book of Environmental Science	Tata Mc Graw-Hill New Delhi
5	Arvind Kumar	A Text Book of Enviornmental science	APH Publishing New Delhi (ISBN 978-8176485906)

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description

1	https://sdgs.un.org/goals	United Nation’s website mentioning Sustainability goals
2	http://www.greenbeltmovement.org/news-and-events/blog	Green Belt Movement Blogs on various climatic changes and other issues
3	http://www.greenbeltmovement.org/what-we-do/tree-planting-fo r-watersheds	Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques
4	https://www.youtube.com/@ierekcompany/videos	International Experts For Research Enrichment and Knowledge Exchange – IEREK's platform to exchange the knowledge in fields such as architecture, urban planning, sustainability
5	www.mahayouthnet.in	UNICEF Intiative for youth leadership for climate action
6	https://eepmoefcc.nic.in/index1.aspx? lsid=297&lev=2&lid=1180 &langid=1	GOI Website for public awareness on enviornmetal issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Intiative for online study material on Enviornmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Intiative for online study material on sustainability
9	https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf	Final list of proposed Sustainable Development Goal indicators
10	https://sustainabledevelopment.un.org/memberstates/india	India’s Strategies to progress across the SDGs.
11	https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html	Challenges to Sustainable Development
12	https://nptel.ac.in/courses/109105190	NPTEL course on sustainable development
13	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview	Swayam Course on Enviornmetal studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on enviornmental studies which encomopasses SDGs, Pollution, Cliamate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analys is-en.pdf	SWOT analysis of Biodiversity
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrkit university publication on Vedic and pre vedic enviornmetal conservation
Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students		

Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	**: MT**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Fifth**	**Scheme**	**: H**

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Cr	Credits	Assessment Scheme													
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	National 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	Internship (16 Weeks)	HINT	INP	5	CCH505	--	16 weeks Industrial Training				--	10	10	--	--	--	--	--	100	40	100#	40	--	--	200
Duration – 8 Week (Online - 28 July 2025 to 19 September 2025)																										
2	Project	HPRJ	INP	5	MTH501	--	--	--	4	2	6	1.6	2	--	--	--	--				50#	20	50	20	100
3	Entreprenurship & Startup	HESU	SEC	5	CCH501	1	2	--	--	1	3	0.8	1	--	--	--	--	--	--	--	--	--	50	20	50
4	Elective – (Management Courses)	--	AEC	5	CCH502/ 503/ 504	-	5	-	-	1	6	1.6	2	1	15*#	35*#	50	20	--	--	--	--	50	20	100
Duration – 6 Week (Offline - 22 September 2025 to 01 November 2025)																										
5	Metal Working Processes	HMWP	DSC	4	MTH401	2	6	--	4	2	12	2.4	2	3	30	70	100	40	--	--	25#	10	25	10	150
6	Corrosion & Surface Protection	HCSP	DSC	4	MTH402	--	8	--	2	2	12	2.4	2	3	30	70	100	40	--	--	25#	10	25	10	150
7	Robotics, IoT & 3-D Printing	HRTP	SEC	4	MTH403	--	--	--	4	--	4	0.8	1	--	--	--	--	--	50	20	--	--	--	--	50
Total						3	21	--	14	8	43		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
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) : 0, Intern./Apprenti./Project./Community (INP) : 2,Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

COURSE NAME : INTERNSHIP (16 WEEKS)
COURSE CODE : CCH505
COURSE ABBREVIATION: HINP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	--	10
	Tutorial Learning		
	Laboratory Learning		
	SLH-Self Learning		
	NLH-Notional Learning		

B. ASSESSMENT SCHEME: -

PAPER DURATION	THEORY				BASED ON LL&TL Practical				BASED ON SLA		TOTAL
NIL	FA- TH	SA- TH	TOTAL		FA -PR		SA-PR		MAX	MIN	
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN			200
	NIL	NIL	NIL	NIL	100	40	100#	40	-	-	

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 System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination.

1. FA-TH represents the average of two class tests of 30 marks each conducted during the semester.
2. If the candidate is not securing the minimum passing marks in FA-PR of any course, then the candidate shall be declared as "Detained" in that semester.
3. If the candidate is not securing the minimum passing marks in the SLA of any course, then the candidate shall be declared as a fail and will have to repeat and resubmit the 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. A 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 The role of metallurgist in industries	PSO2 To create awareness about safety protocols	PSO3 Develop sensitivity about the environmental hazards
Competency:	2	-	-	-	-	3	-	**1**	**1**	**–**
CCH505.1	2	-	-	1	-	1	1	**1**	**3**	**2**
CCH505.2	2	-	1	1	-	2	1	**2**	**1**	**3**
CCH505.3	1	-	-	2	-	2	-	**3**	**–**	**–**

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 – After completion of 4^{th} semester examination and up to total sixteen weeks.

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:

The following activities are expected to be performed by the concerned department at the Institute.
Table of activities to be completed for Internship

S. N	Activity	Suggested Schedule WEEKS
1	Collection of information about the 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	14th week of 4th semester
4	Securing consent letter from parents/guardians	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
9	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
10	Assessment of training by institutional mentor and Industry mentor	5th Semester ESE

Suggestions-

a. The department can take help of alumni or parents of students having contacts 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 potential. However, preference for placement would be given to students who have arranged placement in a 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 releasing students for training.
d. The faculty members, during the industry visit 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 are followed, and safety gear is used by the 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 IN THE 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, and quality control 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.
   a) If yes, whether you offer 16 weeks training: Yes/No
   b) 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 Government Polytechnic, Kolhapur , 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----------
for Industrial training /internship for the period from _____to _____.

~~With respect to abov~~e I give my full consent for my ward to travel to and fro 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 .

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
1.			
2.			

Kindly extend all possible cooperation to the students for above. Thanking you.

Yours Sincerely,

Principal
Government Polytechnic, Kolhapur

CC- Mentor.

.

Format-5

(Undertaking by the students)

To
The Principal,
Government Polytechnic, Kolhapur

Subject: Undertaking regarding Placement for Industrial training of 16 weeks duration.

I Mr./Ms. _____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:Kolhapur

Date:

Signature of the student

GOVERNMENT POLYTECHNIC, KOLHAPUR

Evaluation Sheet for Formative Assessment of Internship

Academic Year: Department: Metallurgical 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						PA Marks by Mentor faculty (20 Marks) [B]	Total [Marks 100] [A]+[B]
		WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WKN 7	WK 8	WK 9	WK 10	WK 11	WK 12	WK 13	WK 14	WK 15	WK 16	Total [80 Marks] [A]		

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 Quarterwise. [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	Average of column

DAILY DIARY FORMAT TO BE MAINTAINED BY STUDENT

Week 1: From _____To _____

Day	Activities carried out	Remark
1		
2		
3		
4		
5		
6		

Signature of Mentor : _____

Signature of Industrial Supervisor : _____

The same format need to follow for every week of the industrial training.

COURSE NAME : PROJECT
COURSE CODE : MTH501
COURSE ABBREVIATION : HPRJ

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	-	2
	Tutorial Learning	-	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	100
--	-	-	-	-			50#	20	50	20	

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 ExaminationNote :

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 course is intended to understand facts, concepts and techniques of electrical equipment in

order to troubleshoot and repair. The student will be able to develop the skill of cost estimation, procurement, fabrication, manufacture, test, and install of various components used in the electrical field. This will help the student to acquire skills and attitudes so as to do the function of supervisor in industry and also can start his/her own small scale enterprise.

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. Carry out the selected project work as a group member.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

1. Plan and identify materials, processes and other resources optimally.
2. Develop innovative and creative idea.
3. Develop leadership, interpersonal skill and team work.
4. Develop sense of environmental responsibility.
5. Purchase raw material/standard parts and interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.
6. Prepare a structured report.

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 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
1. Plan and identify materials, processes and other resources optimally.	3	1	1	1	-	1	3	3	--	--
2. Develop innovative and creative idea	3	3	3	2	-	1	2	3	1	--
3. Develop leadership, interpersonal skill and team work.	-	-	-	-	2	2	-	3	--	--
4. Develop sense of environmental responsibility.	2	-	-	1	2	-	-	-	2	3
5. Purchase raw material/standard parts	1	1	-	1	-	-	-	3	--	2

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 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
and interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.										
6 Prepare a structured report	2	1	1	1	-	2	2	3	--	1

F. CONTENT:-

Sr. No.	Topics/ Subtopics
CO1 : Plan and identify materials, processes and other resources optimally.	
1	1.1 Literature survey 1.2 Project identification
CO2 : Develop innovative and creative idea.	
2	2.1 Initial Design
CO3 : Develop leadership, interpersonal skill and team work.	
3	3.1 Project Design
CO4 : Develop sense of environmental responsibility.	
4	4.1 Identify impact of project on society and environment, if implemented in large scale.
CO5 : Purchase raw material/standard parts and interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.	
5	5.1 Project implementation 5.2 Project testing 5.3 Project installation or commissioning
CO6 : Acquire knowledge and latest changes in technology.	
6	6.1 Report writing and presentation

G. Self-Learning Activities for Diploma Project Course

During the course of the project, several self-learning activities were undertaken to develop technical knowledge, practical skills, and project management abilities. These activities helps enhance student understanding of the project domain and supported independent problem-solving. The key self-learning areas are summarized below:

1. **Understanding Project Background:**
    - Study similar projects, case studies, and past reports to understand the problem and solution approach.
2. **Tool and Software Learning:**

- Learn essential tools such as 3D Printing, IoT and Excel through online tutorials and practice.

3. **Component Study and Selection:**
   - Gain knowledge of components by reading datasheets and specifications.
4. **Design of proposed work:**
   - Practice the project work to validate project ideas before physical implementation.
5. **Practical Skill Development:**
   - Improve hands-on skills such as soldering, wiring, programming, and assembly through repeated practice.
6. **Data Analysis and Testing:**
   - Learn to collect and analyze project-related data, conduct basic testing, and interpret results for system improvement.
7. **Report Writing and Documentation:**
   - Understood the structure and format of technical project reports, including proper formatting, flowcharts, and referencing.
8. **Presentation and Communication Skills:**
   - Practice delivering project presentations and responding to viva questions by studying sample videos and mock sessions.
9. **Time and Team Management:**
   - Develop task schedules, allocated responsibilities, and monitored project milestones using planning tools.

H. Assessment Criteria

i) Formative Assessment of Project Work :-

Sr. No.	Evaluation Criteria	Marks
1.	Literature survey/review	5
2.	Project identification	5
3.	Initial design/ synopsis	5
4.	Detailed design	10
5.	Project implementation	5
6.	Project testing and installation	10
7.	Report writing	5
8.	Presentation	5
Total		**50**

ii) Summative Assessment of Practical :

Sr.no	Criteria	Marks
1	Project demonstration & execution	10
2	Project presentation	10
3	Contribution in project	10
4	Subject knowledge	10
5	Question & answer	10
Total		**50**

I. Instructional Methods:

a. Discussions.
b. Industrial visits.
c. Time bound assignments and work.
d. Project Exhibition
e. Mock presentation of project

J. Teaching and Learning resources:

1. Oscilloscope
2. Soldering station with drill machine
3. PCB formulation kit
4. Clip on meter/ multi-meter/ power supplies.
5. IC tester/ continuity tester/ Component tester
6. Auto-transformer
7. Other equipment as per the need of the project
8. Simulation tools
9. Computer

K. Reference Books:

1. Project related reference books.
2. Various electrical and electronics journals.
3. Company handbooks.

L. Learning Website & Software

i. www.nptel.iitm.ac.in
ii. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine learning-fall-2006/
iii. http://www.indiabix.com/online-test/electrical-engineering-test/143

M. Guidelines for report writting

Arrangement of Contents:

1. Cover Page or Title Page
2. Declaration
3. Certificate by Guide
4. Acknowledgment
5. Preface
6. List of Symbols
7. List of Abbreviations
8. List of Tables
9. List of Figures
10. Table of Contents
11. Abstract
12. Introduction
13. Review of literature
14. Research Methodology
15. Data Analysis & Finding
16. Suggestion & Conclusion

17. Bibliography
18. Appendix

Paper & Typing dimension :

Page : A4 (ON ONE SIDE)
Margin : TOP 15mm
: BOTTOM 15mm
: RIGHT 15mm
: LEFT 30mm
Font : Times New Roman
Size : 12 points (excect the cover page, title page, headings and titles)
Spacing between lines: 1.15 (excect the change in paragraph, cover page, title page, headings and titles)
Header : Title of the project & Academic Year
Footer : Short name of institute, page number (on left side)

***

Course Name : **ENTREPRENEURSHIP AND START-UP**
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:1 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.

i) 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 management	PO 7 Life-long learning	PSO1	PSO2	PSO2
Competency										
CCH501-1	2	2	2	-	-	3	2			
CCH501-2	2	2	2	2	-	3	2			
CCH501-3	2	2	2	2	-	3	2			
CCH501-4	2	2	2	2	-	3	2			
CCH501-5	2	2	2	2	-	3	2			

F. CONTENT:

i. Practical Exercise:

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**

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 centres: 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: -

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

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Observation and recording	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 (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

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	--	
	Laboratory Learning	--	
	SLH-Self Learning	01	
	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			
1	15*#	35*#	50@$	20	--	--	--	--	50	20	100

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.

a. 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.
b. 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.
c. Notional Learning hours be reflected in the Time Table.

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

D. *i.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.

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:

To improve management ability of individual through teaching.

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**	PSO1	PSO2	PSO3
Competency: The aim of this course is to improve management ability of individual through teaching.	3	3	2	2	3	3	3			
CCH502-1	3	2	2	2	2	3	3			
CCH502-2	3	3	2	3	2	3	3			
CCH502-3	3	3	3	3	2	3	3			
CCH502-4	2	3	3	3	2	3	3			
CCH502-5	2	3	3	3	2	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 CCH502-1: - 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	**04**	**4**
Course Outcome CCH-502-1: - 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	**06**	**5**
Course Outcome CCH502-1: - 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	**06**	**5**

Course Outcome CCH502-2: 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**	**5**
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	**05**	**4**
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**	**4**
CCH502.4: Practice industrial safety rules, codes, practices and acts.			
7	**INDUSTRIAL ACT & SAFETY** 7.1 Factory Act, Electricity 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 Equipment's (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**	**4**
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**	**4**
	Total	**40**	**35**

Online Exam for this course.

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	--	CCH502.1	04
2	Functions Of Management	02	02	01	CCH502.1	05
3	Human Resource management	02	02	01	CCH502.1	05
4	Forms Of Business organization	02	02	01	CCH502.2	05
5	Materials Management	02	01	01	CCH502.3	04
6	Financial Management	02	01	01	CCH502.3	04
7	Industrial Act & Safety	02	01	01	CCH502.4	04
8	Modern Management Techniques	02	01	01	CCH502.5	04
TOTAL						**35**

H. INSTRUCTIONAL METHODS

a. Lectures cum Demonstrations
b. 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: -

a. https://nptel.ac.in/courses/122/106/122106031/
b. https://nptel.ac.in/courses/110/105/110105154/
c. https://nptel.ac.in/courses/110/101/110101150/
d. https://nptel.ac.in/courses/110/101/110101153/

COURSE NAME : MARKETING MANAGEMENT
COURSE CODE : CCH503
COURSE ABBREVIATION : HMKM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05	2
	Tutorial Learning	--	
	Laboratory Learning	--	
	SLH-Self Learning	01	
	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			
1	15*#	35*#	50@$	20	--	--	--	--	50	20	100

A. 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.

a. 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.
b. 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.
c. Notional Learning hours be reflected in the Time Table.

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

B. *i. RATIONALE:*

The globalization has lead to the requirement of multi-skilled personnel to execute the works and that too in a cost effective way. It is observed that the diploma holder in Engineering has wide spectrum for development, if the enters the marketing field. Provided he has the interest with proper initiative. Marketing now a day can provide fruitful employment to the diploma holder to make a career in marketing.

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:

Work as a marketing personnel for electrical components or business.

C. *COURSE OUTCOMES (COs):*

CCH503-1:-Interpret different marketing techniques.
CCH503-2:-Identify different types of markets.
CCH503-3:-Carry out different marketing works/functions.
CCH503-4:-Assist in marketing work of industrial products.
CCH503-5:-Carry out market studies for products.

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**		
Competency: Work as a marketing personnel for electrical components or business.	3	3	2	2	3	3	3			
CCH503-1:-Interpret different marketing techniques.	3	2	2	2	2	3	3			
CCH503-2:-Identify different types of markets.	3	3	2	3	2	3	3			
CCH503-3:-Carry out different marketing works/functions.	3	3	3	3	2	3	3			
CCH503-4:-Assist in marketing work of industrial products.	2	3	3	3	2	3	3			
CCH503-5:-Carry out market studies for products.	2	3	3	3	2	3	3			

D. CONTENT:

I) PRACTICAL EXERCISES - Not Applicable

II) THEORY

Section I

Sr.No.	TOPICS Sub-Topics	Periods	Marks
CCH503-1:Interpret different marketing techniques.			
1	**Marketing** 1.1 Meaning and significance of marketing 1.2Marketing system 1.3 Concept of marketing 1.4 Product selling 1.5 Trends in modern marketing	8	6
CCH503-2:Identify different types of markets.8			
2	**Markets** 2.1 Meaning of market 2.2 Types of market 2.3 Government and industrial market	8	6
CCH503-3:Carry out different marketing works/functions.			
3	**Functions & Management** 3.1 Marketing functions 3.2 Meaning of marketing 3.3 Management and functioning 3.4 Types of marketing organizations 3.5 Marketing manager and his duties	8	6

Section II

Sr.No.	TOPICS Sub-Topics	Periods	Marks
CCH503-4:Prepare scheme for marketing industrial products.			
4	**Marketing Industrial Products** 4.1 Types of industrial products 4.2 Characteristics and marketing considerations 4.3 Marketing planning 4.4 Product decision 4.5 Pricing decision	8	6
CCH503-5:Carry out market studies for products.			
5	**Strategies** 5.1 Marketing strategy 5.2 Marketing mix 5.3 Market survey 5.4 Market information systems 5.5 Buying behaviors	8	6
CCH503-6:Devise proper advertising techniques for industrial products.			
6	**Advertising** 6.1 Role of advertising in marketing 6.2 Marketing management without advertising 6.3 Brief introduction to cost component of advertising	8	5
	Total	40	35

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

Topic No.	Name of topic	Distribution of marks (Cognitive level- wise)			Total Marks
		Remember	Understand	Apply	
1	Marketing	2	2	2	6
2	Markets	2	2	2	6
3	Marketing Functions & Management	2	2	2	6
4	Marketing Industrial Products	2	2	2	6
5	Strategies	2	2	2	6
6	Advertising	2	2	1	5
TOTAL					**35**

F. INSTRUCTIONAL METHODS

a. Lectures cum Demonstrations
b. Classroom practices

G. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio presentations, Question Bank

H. REFERENCE BOOKS:

1) Basic Marketing - by Cundiff & Still.
2) Marketing Management - by R. S. Davar.
3) Salesmanship, Sales Management & Advertising - by Satyanarayana.
4) Modern Marketing Management - by R. S. Davar.
5) Marketing Management (cases & Concepts) - by Dholakia, Khurana & Jain

Websites :

i https://nptel.ac.in/courses/122/106/122106031/
ii https://nptel.ac.in/courses/110/105/110105154/
iii https://nptel.ac.in/courses/110/101/110101150/
iv https://nptel.ac.in/courses/110/101/110101153/

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COURSE NAME : PROJECT MANAGEMENT
COURSE CODE : CCH504
COURSE ABBREVIATION : HPRM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	05	2
	Tutorial Learning	--	
	Laboratory Learning	--	
	SLH-Self Learning	01	
	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			
1	15*#	35*#	50@$	20	--	--	--	--	50	20	100

A. 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.

a. 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.
b. 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.
c. Notional Learning hours be reflected in the Time Table.

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

B. RATIONALE:

A diploma holder in Electrical Engineering now a day finds himself entrusted with managing projects or part there off. The age at which he/she is entrusted such responsibilities is declining day by day as a result of which he is stressed much and expected to perform well. This course intends to introduce the elementary aspects of Scientific Project Management whose emphasis is on success, though everybody has his own style of managing projects successfully.

ii. EXPECTED OUTCOME:

Use the principles of project management as a supervisor in relevant works.

C. *COURSE OUTCOMES (COs):*

CCH504-1: Identify project types and the tools/techniques used in it.
CCH504-2: Identify actions for project manager using computer based project management systems as well.
CCH504-3: Assist in establishing a project.
CCH504-4: Carry out project control activities.
CCH504-5: Implement projects using different 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**	**PSO1**		
Competency: Use the principles of project management as a supervisor in relevant works.	3	3	2	2	3	3	3			
CCH504-1	3	2	2	2	2	3	3			
CCH504-2	3	3	2	3	2	3	3			
CCH504-3	3	3	3	3	2	3	3			
CCH504-4	2	3	3	3	2	3	3			
CCH504-5	2	3	3	3	2	3	3			

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

D. CONTENT:

I) PRACTICAL EXERCISES - Not Applicable

II) THEORY

Section I

Sr. no.	Topics / subtopics	Teaching (Hours)	Theory Marks
CCH504-1:Identify the tools and techniques used in project management.			
1	**Project Management and its tools/techniques** 1.1 Idea of project 1.2 Characteristics of project 1.3 Categories of projects 1.4 Project life cycle phases (definition of each phase) 1.5 Project life cycle curve. Tools And Techniques For Project Management 1.6 Selection techniques 1.7 Execution planning and techniques 1.8 Scheduling and co-ordination techniques 1.9 Cost and productivity control techniques. 1.10 Communication and clean up techniques	8	7
CCH504-2:Identify actions for project manager using computer based project management systems as well.			
2	**Project Management System** 2.1 Block diagram with brief description , Computer based project management 2.2 Rationale behind computerized project management systems **Project Management** 2.3 Need of project manager 2.4 Problems of project manager 2.5 Basic education for project manager 2.6 Roles and responsibilities of project management as a profession	8	7
	Total		

Section II

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory Marks
CCH504-3:Work in a group to establish a project.			
3	**Establishing Project** (Scope & Cost) 3.1Guidelines given by planning commission (brief description about guidelines) 3.2 Financing arrangements, capital cost, sources of financing 3.3 Internal and external sources 3.4 Terms of finance Short, intermediate and long term 3.5 Names of financial institutions with their mode of working in brief 3.6 Preparation of cost estimates types of estimates with very brief description: Order of magnitude, study estimate, preliminary estimate, Definitive estimate, detailed estimate.	8	7

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory Marks
CCH504-4:Carry out project control activities.			
4	**Project Activities And Profitability** 4.1 Project implementation schedule 4.2 Basis of time estimation 4.2.1 Time study 4.2.2 Previous project data 4.2.3 Estimates from the vendors/ contractors 4.2.4 Allocated time and committed time. Overall implementation schedule Bar chart Evaluation of project profitability methods 4.2.5 Pay-back period (PBP) return on investments (ROI) concept of zero date 4.3Pre-project activities and advance actions (very brief description)	8	7
CCH504-5:Implement project task using different techniques.			
5	**Implementation Control & Monitoring** **Implementation** 5.1 Work breakdown structure 5.2Project execution plan (brief description) Project procedure manual 5.3 Project control system 5.4 Need for flexibility 5.5 Project diary **Control & Monitoring** 5.6 Direction reviews meeting creativity techniques such as questioning 5.7 Attribute listing 5.8Brain Communications in a project feed back and forward 5.9 Unscheduled meetings and social get-togethers	8	7
	Total	40	35

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

Topic No.	Name of topic	Distribution of marks (Cognitive level- wise)			Total Marks
		Remember	Understand	Apply	
1	Project Management and its tools/techniques	3	2	2	7
2	Project Management System	3	2	2	7
3	Establishing Project	3	2	2	7
4	Project Activities and Profitability	3	2	2	7
5	Implementation Control & Monitoring	3	2	2	7
TOTAL					**35**

F. INSTRUCTIONAL METHODS

a. Lectures cum Demonstrations
b. Classroom practices

G. TEACHING AND LEARNING RESOURCES:

Chalk board, LCD presentations, Audio presentations, Question Bank

H. REFERENCE BOOKS:

1. Project Management - by S. Choudhury (Tata McGraw Hill Pub.)
2. Project Management - A System Approach to planning, Scheduling & Controlling By Harold Kerzner (CBS Publishers & Distributors)

I. Websites :

i https://nptel.ac.in/courses/122/106/122106031/
ii https://nptel.ac.in/courses/110/105/110105154/
iii https://nptel.ac.in/courses/110/101/110101150/
iv https://nptel.ac.in/courses/110/101/110101153/

***

COURSE ID :
COURSE NAME : Metal Working Processes
COURSE CODE : MTH401
COURSE ABBREVIATION : HMWP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	06	02
	Tutorial Learning	--	
	Laboratory Learning	04	
	SLH-Self Learning	02	
	NLH- Notional Learning	12	

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	150

(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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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

Metal Working Processes deal with shaping of metal to a suitable form. Each process has its uniqueness in terms of the equipment used and type of products produced. The advantages, disadvantages and applications of various processes give an idea for selection of manufacturing processes for manufacturing of a component.

ii)**INDUSTRY / EMPLOYER EXPECTED OUTCOME**

Familiarize with the entire manufacturing process of various metal working processes.

E. COURSE LEVEL LEARNING OUTCOMES(COS)

1 . Describe the fundamentals of metal forming in monitoring the metal working processes.
2. Apply the terminologies, engineering fundamentals and process parameters of metal working in producing rolled products.
3. Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by wire drawing.
4. Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by forging.
5. Describe terminologies, engineering fundamentals and process parameters of metal working in producing products by extrusion.
6. Apply the terminologies, engineering fundamentals and process parameters of metal working in producing products by sheet metal working.

Competency, course outcomes and programme outcomes /programme specific 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO1- Describe the fundamentals of metal forming	3	3	2	2	2	2	2	3	3	2
CO2- Apply the terminologies in producing rolled products	3	3	2	3	2	3	2	2	3	3
CO3- Apply the terminologies in producing products	3	3	2	3	2	2	2	2	3	3

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 Society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO1 The role of metallurgist in industries	PSO2 To create awareness about safety protocols	PSO3 Develop sensitivity about the environmental hazards
by wire drawing										
CO4- Use the terminologies in producing products by forging	3	3	2	2	3	2	2	2	2	2
CO5- Use the terminologies in producing products by extrusion	3	3	2	2	2	2	2	3	3	2
CO6- Use the terminologies in producing products by sheet metal working	3	3	2	2	3	2	2	2	3	3

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 experiences	CO
1	Demonstration of rolling process by using prototype two high mills.	2
2	Drawing of aluminum and copper rods using dies.	3
3	Demonstration of various forging operations and other forging equipments such as hammers, presses, dies.	3
4	Demonstration of extrusion process by using videos.	4
5	Demonstration of various Sheet metal processes and operation	5

Course Content:

Section I

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
CO1 : Describe the fundamentals of metal forming			
1.	**Introduction** 1.1 Introduction of Metal forming. 1.2 Classification of metal forming processes. 1.3 Hot working and Cold working Preheating the steel: Soaking pits, Continuous furnaces ***IKS** References of the castings found in excavation of ancient sites. Manufacturing of canons during middle Ages.	04	6
CO2 - Apply the terminologies in producing rolled products			
2.	**Rolling** 2.1 Definition of Rolling of metal, Principles of rolling, 2.2 Classification of rolling mills- based on roll stand design (two high, three high, four high, planetary mill), based on temperature and based on products. 2.3 Rolling Geometry: Action of forces, neutral plane, angle of bite, neutral angle, lagging zone, forward slip zone, draught, spread, rolling load calculations, Roll bite condition, Maximum reduction, Relation between μ, rolling load and torque. 2.4 Rolling Mill construction, Auxiliary equipment, Plant layout, 2.5 Roll pass design- various passes, typical roll pass sequence for standard sections. Rolling of tubes. Defects of rolling process.	08	14
CO3 - Apply the terminologies in producing products by wire drawing			
3	**Drawing of Wire and rod drawing** 3.1 Definition of drawing, size range of starting and finishing materials, mean scale, preparation of wire for drawing cleaning, coating, and baking of wire. Use of lubricant. 3.2 Drawing Dies- Material, design, various zones. 3.3 Wire drawing machines- Draw benches, chain type and bull block draw benches, Multiple pass (continuous wire drawing) 3.4 Sink drawing and tube drawing, types of mandrels. 3.5 Patenting- Treatment cycle, advantages, disadvantages, applications. Defects due to process & metal structure.	06	14

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
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 Subtopics	Teaching (Hours)	Theory evaluation Marks
CO4 - Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by forging			
4	**Forging of metals** 4.1 Definition of forging, Selection of steel for forging, heating for forgings, forging temperature interval, various hand tools, hand forging operations- drawing out, fullering or spreading, chiseling, upsetting, bending, punching and piercing. 4.2Forging die design considerations, applications of forging. 4.3 Machine forging– Principle and working of various forging hammers and presses- Spring hammer, Pneumatic hammer, Single and double acting air and steam hammer, Belt and board drop hammer, Hydraulic press, Screw friction press, Mechanical press. 4.5 Forging defects due to process & metal structure.	**06**	**14**
CO5: Describe terminologies, engineering fundamentals and process parameters of metal working in producing products by extrusion.			
5.	**Extrusion of metals:** 5.1 Definition -Extrusion 5.2 methods of extrusion- Direct extrusion, Indirect extrusion. Tube extrusion, Impact extrusion, Hydrostatic extrusion 5.3 Design of extrusion die, lubrication, variables in extrusion. 5.4 machines, mandrels, containers and lubricants. Applications of extrusion. Defects due to process & metal structure**.**	06	10

CO6 - Apply the terminologies, engineering fundamentals and process parameters of metal working in producing products by sheet metal working			
6	**Sheet metal working and finishing operations** 6.1 Parts made by sheet metal working, various cutting operations like shearing, blanking, piercing, trimming, shaving, notching or slitting. Clearance between die and punch in blanking and piercing. 6.2 Bending- Clearance between punch and die, spring back, bending with stretching, rubber pad bending, lubrication in bending. Deep drawing, applications of sheet metal working.	06	12
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.			

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

G : List of Assignments under SLA

1. Visit to steel rolling shop and witness the rolling machines and operations.
2. Using wire drawing dies carry out aluminum wire drawing.
3. Visit forging shop and understand various forging tools and operations.
4. Write the description of extrusion process by visiting any extrusion shop.
5. Understand various products produced with sheet metal working.

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

Specification Table for setting question paper for semester end theory paper

Sr no	Topic	Distribution of Marks				Course Outcome
		Remember	Understand	Application		
1	Introduction	04	02	-	06	1
2	**Rolling of metal**	06	04	04	14	2
3	**Drawing of wire and rod**	06	04	04	14	3
4	**Forging of metals**	04	04	04	12	4
5	**Extrusion of metals**	04	04	02	10	5
6	**Sheet metal working**	04	04	06	14	6
	Total	28	22	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	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**

J) Instructional Methods:

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

Text-Books:

Sr. No.	Author	Title	Publisher
1.	**George E. Dieter**	**Mechanical Metallurgy**	**McGrawhill International Book Co.**
2.	**V. Masterov, V. Berkovsky**	**Theory of Plastic deformation & metal working.**	**MIR Publication**
3.	**Claud, Pearson &Parkins**	**The Extrusion of metals.**	**Chapman and Hall, London.**

4.	**K.Burtsev**	**Rolling Practice**	**MIR Publication**
5.	**Raymond A. Higgins**	**Engineering Metallurgy**	**English University Press.**
6	**S. E.Rusinoff**	**Forging & Forming Metals.**	**D.B.Taraporevala& Sons.**

Reference Books:

Author	Title	Publisher
-	Metal hand book no-6	American Soc. Of Metals

Websites:

1. https://en.wikipedia.org/wiki/Metalworking
2. https://www.iitg.ac.in/engfac/ganu/public_html/Metal%20forming%20processes_full.pdf
3. u-Tube – Rolling, Forging, Extrusion, Sheet metal working processes.

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COURSE ID :
COURSE NAME : CORROSION & SURFACE PROTECTION
COURSE CODE : MTH402
COURSE ABBREVIATION : HCSP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	08	02
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	02	
	NLH-Notional Learning	12	

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				150
	MAX	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	30	70	100	40	--	--	25#	10	25	10	

(Total IKS Hrs for Sem. : Nil)

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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE

Corrosion is one of the important phenomenon occurring in nature. Corrosion leads to loss of metals & its surface properties. If due care is not taken to prevent corrosion, it leads to failure of components. Therefore it is essential to minimize the process of corrosion if not completely prevented. It is therefore necessary to understand about the corrosion and surface protection methods.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understand the mechanism of corrosion and select appropriate surface protection method.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Understand principle of corrosion and factors influencing corrosion.
2. Detect types of corrosion.
3. Select proper corrosion control process.
4. Select appropriate surface preparation process.
5. Determine appropriate surface protection method for particular application.
6. Understand the principle of electroplating.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Understand principle of corrosion and factors influencing corrosion	3	3	3	2	1	2	2	3	1	1
CO-2 : Detect types of corrosion.	3	2	2	1	--	--	1	3	--	1
CO-3 : Select proper corrosion control process.	3	3	3	3	2	1	2	3	1	1
CO-4 : Select appropriate surface preparation process.	3	3	2	3	2	1	2	3	1	1
CO-5 : Determine appropriate surface	3	3	3	3	1	--	2	3	1	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
protection method for particular application.										
CO-6 : Understand the principle of electroplating.	3	2	2	1	--	1	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 experiences	CO
1	Determine the corrosion rate of different metals by weight loss method.	1
2	Prepare a report on mechanism of types of corrosion.	2
3	A case study of corrosion control.	3
4	Practical on removal of oxide scale by grinding and pickling.	4
5	Perform hot dip galvanizing.	5
6	Measure plating thickness by weight change method of galvanized Mild Steel.	5
7	Perform copper plating.	6
8	Rectify defects in Electro-plated components and suggest remedial measures for it.	6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Understand principle of corrosion and factors influencing corrosion			

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
1	**1. Corrosion** 1.1 Introduction, Definition 1.2 Electrochemical Series, Its advantages and limitations & applications 1.3 Galvanic Series, Its advantages, limitations and applications 1.4 Growth Laws 1.5 Factors influencing corrosion.	06	06
CO2: Detect types of corrosion			
2	**2. Types of Corrosion** 2.1 Dry Corrosion : Types, Oxidation corrosion - Mechanism, Types of films, Pilling-Bedworth rule. 2.2 Wet Corrosion : Mechanism – Hydrogen Evolution & Oxygen Absorption. 2.3 Action of Hydrogen : Hydrogen Embrittlement & Hydrogen Attack. 2.4 Other Types of Corrosion: a) Galvanic Corrosion, b) Concentration Cell Corrosion, c) Atmospheric Corrosion, d) Underground Corrosion, e) Microbiological Corrosion f) Stress Corrosion, g) Season Cracking, h) Erosion corrosion i) Pitting Corrosion, j) Intergrannular Corrosion	16	18
CO3: Select proper corrosion control process			
3	**3. Corrosion Control** 3.1 Proper selection of materials, Proper design and fabrication procedure 3.2 Passivity 3.3 Protection by Inhibitors : Anodic & Cathodic Inhibitors 3.4 Cathodic protection	08	10

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4 : Select appropriate surface preparation process			

4	**4. Surface Preparation** 4.1 Necessity of surface preparation. 4.2 Types of surface preparation methods: Mechanical, chemical & electrochemical methods. a) Mechanical methods - Grinding, Polishing, Brushing, Buffing b) Chemical methods - Degreasing, Detergent cleaning, Acid & Alkali cleaning. c) Electrolytic cleaning & ultrasonic cleaning. 4.3 Factors for selection of proper cleaning methods.	06	08
CO5 : Determine appropriate surface protection method for particular application			
5	**5. Surface Protection** 5.1 Pretreatment before surface coating 5.2 Metallic coating : Hot Dipping : a) Galvanizing – Principle, Process, Advantages, Limitations, Applications. b) Tinning – Principle, Process, Advantages, Limitations, Applications. Cementation, Metal cladding, Metal spraying, Sputtering 5.3 Non-metallic coating : Paints – Requisites of a good paint, Constituents of paints. 5.4 Chemical Conversion Coatings – Phosphate coatings, Chromate coatings, Chemical oxide coatings, Anodized coatings.	18	20
CO6 : 6. Understand the principle of electroplating			
6	**6. Electroplating** 6.1 Principle of electroplating, Faraday's law of electrolysis. 6.2 Electroplating equipments and plant layout, Pretreatments before plating. 6.3 Important platings a) Copper Plating : Bath Composition, Operating Conditions b) Chromium Plating : Bath Composition, Operating Conditions c) Nickel Plating : Bath Composition, Operating Conditions 6.4 Plating thickness Tests 6.5 Defects in Plating : Causes and Remedies	06	08

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

G. List of Assignments under SLA – (Any Six)

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Prepare a report on electrochemical series and galvanic series.	2
2	Prepare a report based on various corrosion control methods.	2

3	Draw the plant layout of Hot Dip Galvanizing. Describe in detail about each tank.	2
4	Discuss about plating defects, write down its causes and suggest suitable remedies	2
5	Critical analysis of pitting type corrosion	2
6	Detail study of passivity	2
7	Study causes and remedies of electroplating Defects	2

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	Corrosion	2	4	--	06	1
I / 2	Types of Corrosion	6	10	2	18	2
I / 3	Corrosion Control	4	2	4	10	3
II /4	Surface Preparation	2	2	4	08	4
II /5	Surface Protection	4	6	10	20	5
II / 6	Electroplating	2	2	4	08	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/	05

	Communication/Presentation	
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. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Company
2	Material Science and Metallurgy for Engineer	Dr. V.D. Kodgire	Everest Publishing House
3	Introduction to Physical Metallurgy	Sidney H. Avner	Tata McGraw-Hill
4	Corrosion Engineering	Fontana	McGraw Hill
5	Metals Handbook - Corrosion	Ninth Edition	----

M. Learning Website & Software

1. https://www.youtube.com/watch?v=q3c-ig5G3bA
2. https://en.wikipedia.org/wiki/Corrosion
3. https://byjus.com/chemistry/corrosion/

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COURSE ID :
COURSE NAME : Robotics, IoT and 3-D Printing
COURSE CODE : MTH403
COURSE ABBREVIATION : HRITP

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	--	01
	Tutorial Learning	--	
	Laboratory Learning	04	
	SLH-Self Learning	--	
	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
--	--	--	--	--	50	20	--	--	--	--	

(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 ExaminationNote : (TNR 11 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.

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, difficult and dangerous tasks. The use of robot helpful in hazardous and challenging environments. 3D printing offers significant advantages, including rapid prototyping, design freedom for complex shapes, customization and personalized products, cost efficiency for low-volume and complex parts, sustainability through reduced waste and efficient material use and on-demand production. IoT is responsible for the super-fast evolution of industry 4.0, where the operations are mostly automated. Thus eliminating the need for much human intervention.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop and implement creative solutions for real time problems that can enhance efficiency, safety and convenience across various domains.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to:

1. Identify basic components of industrial robot.
2. Understand the use of robots for various applications.
3. Understand the working and use of IoT.
4. Understand the process of 3D printing technology and its 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Identify basic components of industrial robot	2	1	3	2	--	1	1	--	1	--
CO-2 : Select Industrial robot for given applications	3	2	2	1	--	1	1	2	2	1
CO-3 : Understand the fundamental concepts of IoT	2	3	3	3	1	2	2	3	2	1
CO-4 : Understand the fundamentals of 3D printing tech. and its applications	3	3	2	3	1	2	2	3	1	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 experiences	CO
1	Introduction to use of robotics in industry.	1
2	Joining of metal parts with MIG welding using robotic arm.	2
3	Working of CNC robot.	2
4	Pick and place a job through two jaw griper and suction cup using robotic arm.	1,2
5	Introduction to IoT.	3
6	Industrial safety using IoT technology.	3
7	Introduction of 3D printing and its types.	4
8	3D Model designing and printing.	4

II) Theory - NA

G. List of Assignments under SLA – NA

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 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 : NA

J. Instructional Methods:

1. Practical with Demonstration,
2. Laboratory experiences and laboratory interactive sessions.
3. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Introduction to Industrial Robotics	RAmchandran Nagarajan	Pearson Education India New Delhi2006,ISBN978-93-325-4480-2

M. Learning Website & Software

1. https://ifr.org/
2. https://nptel.ac.in/courses/112105319
3. https://nptel.ac.in/courses/112105249
4. https://nptel.ac.in/courses/106105166
5. https://en.wikipedia.org/wiki/3D_printing
6. https://www.hubs.com/guides/3d-printing

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Government Polytechnic Kolhapur

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

Diploma In Metallurgical Engineering

Programme Code	**: MT**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Sixth**	**Scheme**	**: H**

Sr No	Course Title	Abbreviation	Course Type	Level	Course Code	IKS Hrs per sem	Learning Scheme					Credits	Assessment Scheme											Total Marks
							Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	Notional Learning Hrs/Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		
																		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	Failure Analysis and Selection of Materials	HFASM	DSC	4	MTH404	--	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	50	20	200
2	Powder Metallurgy	HPM	DSC	4	MTH405	--	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	Metal Joining	HMJ	DSC	4	MTH406	2	4	--	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4	Extraction of Non-Ferrous Metals	HENFM	DSC	4	MTH407	--	4	--	--	--	4	2	3	30	70	100	40	--	--	--	--	--	--	100
5	Elective – Metallurgy Courses		DSE	5	MTH502/ 503/504	--	4	--	2	--	6	3	3	30	70	100	40	25	10	25@	10	--	--	150
6	Casting Simulation	HCS	SEC	5	MTH505	--	2	--	4	--	6	3	--	--	--	--	--	50	20	50@	20	--	--	100
Total						02	22	--	12	6	40	20				500		150		150		100		900

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

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

COURSE ID :
COURSE NAME : Failure Analysis and Selection of Materials
COURSE CODE : MTH404
COURSE ABBREVIATION : HFASM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	4
	Tutorial Learning	--	
	Laboratory Learning	2	
	SLH-Self Learning	2	
	NLH-Notional Learning	8	

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	50	20	200

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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE

Failures are common in all the applications and demand systematic analysis to reach the root cause. Materials are developed to design better applications and replace existing material to improve the performance. Wear, Corrosion and Fracture contribute majority of the failures hence it is necessary to study them in deep. Knowledge of commonly used materials available in the market helps to accelerate the designing process.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Analyze engineering failures and select suitable materials to prevent them

E. COURSE LEVEL LEARNING OUTCOMES (COS)

1. Apply knowledge of fracture toughness to predict performance of components
2. Define failure, state its causes, correlate failure with microstructure and state categories of material stressors.
3. Apply knowledge of physical properties for selection of materials.
4. Evaluate alternatives, determine performance requirements .
5. Select a material for strength, resistance to corrosion, temperature, wear.
6. Select steels for high strength, heat resistant and corrosion resistant 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1:Apply knowledge of fracture toughness to predict performance of components	3	3	3	3	3	3	3	3	3	2
CO-2 : Define failure, state its causes, correlate failure with microstructure and state categories of material stressors.	3	3	3	3	3	3	3	3	3	2

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-3:Apply knowledge of physical properties for selection of materials.	3	3	3	3	3	3	3	3	3	2
CO-4 Evaluate alternatives, determine performance requirements	3	2	2	1	3	1	3	3	3	2
CO-5 : Select a material for strength, resistance to corrosion, temperature, wear.	3	3	3	3	3	3	3	3	3	3
CO-6 : Select steels for high strength, heat resistant and corrosion resistant applications.	3	3	3	3	3	3	3	3	3	3

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 experiences	CO
1	Study of steps in selection of materials	3
2	Study of different types of failures; ductile, brittle, wear, fatigue, corrosion, stress corrosion.	2
3	Case studies of selection of materials for resistance to corrosion.	5
4	Case studies of selection of materials for resistance to wear.	5
5	Case studies of selection of materials for hot working Dies .	6
6	Case studies of selection of materials for resistance to heat.	5
7	Case studies of selection of materials for cold working Dies .	6

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Apply knowledge of fracture toughness to predict performance of components			
1	**FRACTURE TOUGHNESS:** 1.1 Use of fracture toughness to predict performance of components. 1.2 Plain strain fracture, critical crack size, crack growth under cyclic loads. (No mathematical details)	10	12
CO2: Define failure, state its causes, correlate failure with microstructure and state categories of material stressors.			
2	**FAILURE ANALYSIS:** 2.1 Introduction to Failure Analysis Categories of Stressors – Mechanical, Chemical, Spectrochemical, Thermal, Radiation, Electrical 2.2 Types of failure – Distortion, fracture, corrosion, wear 2.3 Steps in investigation of failure – Collecting information, question to be raised in examination of failure 2.4 Preparation of failure analysis report 2.5 Types of fractures-Ductile and |Brittle fracture, Comparison between ductile and brittle fracture, ductile to brittle transitions in steels. 2.6 Causes of failure	10	12
CO3: Apply knowledge of physical properties for selection of materials			
3	**PHYSICAL PROPERTIES AND SELECTION OF MATERIALS FOR VARIOUS APPLICATIONS** 3.1 Machinability – concept of machinability, measurement of machinability, machinability index of various metals and alloys. 3.2 Wear resistance – metal-to-metal (lubricated and non-lubricated) metal to non-metal dry friction – metal to non – metal – particle impact – – metal to fluid. Selection of materials for higher wear resistance.	10	10

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks

CO4 : Evaluate alternatives, determine performance requirements			
4	**INTRODUCTION** 4.1Early materials used in stone age, Bronze age and Iron age. 4.2 History of study of fractures in materials. 4.3 Role of material selection in design process 4.4 Material selection factors-Properties, Availability, Economics, Business issues 4.5 Factors affecting material prices, material substitution and alternate materials. 4.6 Computer's use for selection of material.	08	10
CO5 : Select a material for strength, resistance to corrosion, temperature, wear.			
5	**HIGH TEMPERATURE PROPERTIES, CORROSION RESISTANCE & STAINLESS STEELS** 5.1 High temperature properties – selection of materials for use at elevated temperatures, super alloys. 5.2 Chromium – steels – role of chromium in stainless steels classification of stainless steels – AISI specifications – Applications of different types of stainless steels carbide precipitation in stainless steels – stabilization treatment 5.3 Study of lightweight materials used in battery with reference to electric vehicles.	10	12
CO6 : Select steels for high strength, heat resistant and corrosion resistant applications			
6	**STEEL SELECTION** 6.1 Tools steels – classification of tool steel on the basis of application. Properties required for different types of tool steels – Heat treatment of HSS cutting tools. Tool steels required for cutting, cold-working dies, hot working dies. 6.2 Selection of materials and processes for tools and a few components of automobile engines, machine tools, foundry metal-working equipment, testing machine, ore-dressing equipment.	12	14

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

List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Prepare a chart showing a case study on selection of ferrous materials for various applications.	6
2	Prepare a chart showing a case study on selection of non-ferrous materials for various applications.	6

3	Prepare a chart showing various types of failures.	4
4	Prepare a chart showing comparison of different types of failure	4
5	Prepare chart explaining factors influencing Brittle fracture.	4
6	Prepare chart explaining procedure of failure analysis.	6

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	Fracture toughness	6	4	2	12	1
I / 2	Failure analysis	4	6	2	12	2
I / 3	Physical properties and selection of materials for various applications	4	2	4	10	3
II /4	Introduction	6	2	2	10	4
II /5	High temperature properties, corrosion resistance & stainless steels	6	2	4	12	5
II / 6	Steel selection	4	4	6	14	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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Dieter	Mechanical Metallurgy	McGraw-Hill international
2	Reed-Hill	Physical Metallurgy Principles	East-West Press Pvt. Ltd., New Delhi

M. Learning Website & Software

1. https://www.youtube.com/watch?v=WERoSRcnafA
2 https://youtu.be/QjI3E4haOp4?feature=shared
3. https://www.youtube.com/watch?v=jopKXJtZUcE
4. https://www.youtube.com/watch?v=zH05sDLKMoU

***

COURSE ID :
COURSE NAME : Powder Metallurgy
COURSE CODE : MTH405
COURSE ABBREVIATION : HPM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	04
	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	

(Total IKS Hrs for Sem. : Nil)

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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE

Powder metallurgy is one of the important techniques of manufacturing metallic components used in several fields of engineering like automotive, atomic energy, defense, high temperature technology etc. This course deals with the production, testing, blending, compaction of metal powders and sintering. It also included the manufacturing of various powder metallurgical products.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Perform different tests on metal powders for determination of various properties and select appropriate compaction process and sintering furnace for particular powder metallurgical application.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Compare the powder metallurgy method with other manufacturing processes.
2. Produce the metal powder with some metal powder production processes.
3. Measure different properties of powders using various tests.
4. Select the appropriate compaction process for particular application.
5. Understand the mechanism of sintering.
6. Draw the flowsheet for manufacturing of various powder metallurgical products.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Compare the powder metallurgy method with other manufacturing processes.	3	1	3	--	1	--	2	3	--	--
CO-2 : Produce the metal powder with some metal powder production processes.	3	1	2	1	--	--	1	3	--	1
CO-3 : Measure	3	3	3	3	2	1	2	3	1	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
different properties of powders using various tests.										
CO-4 : Select the appropriate compaction process for particular application.	3	2	2	2	1	1	--	3	2	1
CO-5 : Understand the mechanism of sintering.	3	3	1	2	1	--	1	3	1	1
CO-6 : Draw the flowsheet for manufacturing of various powder metallurgical products.	3	3	2	1	1	3	2	3	1	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 experiences	CO
1	Study various metal powder manufacturing processes.	2
2	Measure size distribution of metal powder by sieving method.	3
3	Calculate apparent density of metal powder.	3
4	Calculate tap density of metal powder.	3
5	Calculate flow rate of metal powder.	3
6	Study various types of die compaction techniques.	4
7	Study sintering of compacted products.	5
8	Draw the flow-sheets for production of bearings, friction materials and Sintered Cemented Carbides.	6
9	Visit to powder metallurgical company.	All

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Compare the powder metallurgy method with other manufacturing processes			
1	**1. Introduction :** 1.1 Principle of powder metallurgy, its applications, advantages and limitations. 1.2 Comparison of powder method with other shaping or forming methods of production. 1.3 Scope of powder metallurgy in industry.	06	06
CO2: Produce the metal powder with some metal powder production processes			
2	2. **Metal Powder Production :** 2.1 Classification of metal powder production methods. 2.2 Various methods of metal powder production such as a. Machining, b. Crushing, c. Milling, d. Atomization, e. Condensation, f. Thermal Decomposition, g. Reduction, h. Electrodeposition, i. Intergranular Corrosion.	12	14
CO3: Measure different properties of powders using various tests.			
3	**3. Characteristics and Testing of Metal Powders** 3.1 Sampling – Coning and Quartering. 3.2 Particle size measurement – Sieving method, Sedimentation and decantation method, Elutriation method. 3.3 Particle shape and size distribution, its measurement, Hall flow meter. 3.4 Density of metal powders- Apparent density and its measurement, tap density and its measurement. 3.5 Flow rate and its measurement. 3.6 Definations – Compressibility, compactibility, specific surface, green strength.	12	14

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation

			Marks
CO4 : Select the appropriate compaction process for particular application.			
4	4. **Powder Conditioning and Compaction** 4.1 Powder conditioning – Preliminary heat treatment, blending process. 4.2 Powder compaction : Classification of powder compaction- a. Pressureless shaping techniques : Loose sintering, slip casting, slurry casting. b. Cold pressure shaping techniques : Mechanism, role of lubrication, die materials and its properties, Presses- mechanical press, hydraulic press, die compaction techniques, types – isostatic pressing, explosive forming, powder rolling, cycle compaction, powder extrusion. c. Pressure shaping technique with heat : Hot pressing, sinter forging, hot rolling, hot isostatic compaction.	14	18
CO5 : Understand the mechanism of sintering.			
5	5. **Sintering** 5.1 Sintering – Principle, purpose. 5.2 Stages of sintering. 5.3 Mechanism of sintering. 5.4 Liquid phase sintering – Definition, stages, advantages. 5.5 Sintering Furnace – Construction, classification, atmosphere. 5.6 Post sintering operations- sizing, coining, impregnation.	08	10
CO6 : Draw the flowsheet for manufacturing of various powder metallurgical products.			
6	**6. Applications** 6.1 Bearing Materials – Applications, properties, methods of production, oil impregnated bearings. 6.1 Friction Materials - Applications, properties, methods of production, formulation. 6.2 Tool Materials - Applications, properties, production of cemented carbide. 6.3 Ferrites – Applications, production.	08	08

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

G. List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Collect information about new development in powder metallurgy	5
2	Search about the production of metal powder by new techniques	5
3	Collect information about presses for compaction.	5
4	Gather data about new compaction techniques of metal powder compaction.	5
5	Collect data about the furnaces and atmosphere for	5

	sintering	
6	Prepare the flowsheet for the production of particular application by powder metallurgy process.	5

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	2	2	2	06	1
I / 2	Metal Powder Production	4	4	6	14	2
I / 3	Characteristics and Testing of Metal Powders	2	6	6	14	3
II /4	Powder Conditioning and Compaction	2	6	10	18	4
II /5	Sintering	2	6	2	10	5
II / 6	Applications	2	2	4	08	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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Powder Metallurgy	A.K. Sinha	Dhanpat Rai Publications
2	Material Science and Metallurgy for Engineers	V.D. Kodgire	Everest Publishing House
3	ASM Handbook, Volume 7: Powder Metallurgy	ASM International	ASM International

M. Learning Website & Software

https://www.youtube.com/watch?v=uRVaLUQUmA8
https://www.youtube.com/watch?v=oDA3aIDmkv8
https://www.youtube.com/watch?v=22ytR__l22g

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COURSE ID :
COURSE NAME : METAL JOINING
COURSE CODE : MTH406
COURSE ABBREVIATION : HMJ

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	04
	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	

(Total IKS Hrs for Sem. : Nil)

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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE

Various parts of engineering components are required to be joined on regular basis. The growing competition & developments in the production methods create intricate problems as regards to maintenance & repairs. Metal joining is the solution for this. It is therefore necessary to impart the basic knowledge of joining to the students.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select and perform appropriate welding method for particular application**.**

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Compare the welding with riveting and casting.
2. Select appropriate common welding process for particular application.
3. Suggest special welding process of given application.
4. Draw welds positions, weld joint design and microstructure of Heat Affected Zone.
5. Compare soldering with brazing.
6. Suggest suitable remedies for various welding defects and perform various destructive and non-destructive tests on welded parts.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Compare the welding with riveting and casting.	3	3	3	2	1	2	2	3	1	1
CO-2 : Select appropriate common welding process for particular application.	3	2	2	1	--	--	1	3	--	1
CO-3 : Suggest	3	3	3	3	2	1	2	3	1	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
special welding process of given application.										
CO-4 : Draw weld positions, weld joint design and microstructure of Heat Affected Zone.	3	2	2	2	1	1	--	3	1	1
CO-5 : Compare soldering with brazing	3	3	1	2	--	--	2	3	1	1
CO-6 : Suggest suitable remedies for various welding defects and perform various destructive and non-destructive tests on welded parts	3	3	2	3	--	1	2	3	--	--

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 experiences	CO
1	Draw weld positions and joint design.	1
2	Draw arrangement of oxy-acetylene welding process and types of flames of it.	2
3	Perform Shielded Metal Arc Welding process.	2
4	Prepare a report on Submerged Arc Welding Process.	2
5	Conduct spot welding and seam welding.	3

Sr. no	Laboratory experiences	CO
6	Perform Thermit Welding.	3
7	Draw the Heat Affected Zone of welded part and explain it in detail for low carbon steel.	4
8	Perform soldering and brazing	5
9	Prepare a report on causes and remedies on various welding defects.	6
10	Perform Nick-Break Test.	6
11	Visit to company for various joining processes.	All

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Compare the welding with riveting and casting			
1	**1. Introduction :** 1.1 Welding – Principle, Advantages, Limitations, Applications & Classification. 1.2 Principle of casting, comparision of welding with riveting and casting. 1.3 Requirements of welding processes. 1.4 Weldability, Factors effect on weldability. 1.5 Weld positions, weld joint design. 1.6 Safety rules and regulations in welding shop. IKS – Development of joining processes.	06	06
CO2: Select appropriate common welding process for particular application			
2	2. **Welding Methods :** 2.1 Gas Welding Process : Principle, Types of Flames, Chemistry of oxy-acetylene flame, Welding techniques – Leftward and Rightward, Fluxes and its functions, Equipments, Working, Advantages, Limitations & Applications. 2.2 Shielded Metal Arc Welding Process: Principle, Equipments, Working, Advantages, Limitations & Applications. 2.3 MIG Welding Process: Principle, Equipments, Working, Advantages, Limitations & Applications. 2.4 TIG Welding Process: Principle, Equipments, Working, Advantages, Limitations & Applications. 2.5 Submerged Arc Welding Process: Principle, Equipments, Working, Advantages, Limitations & Applications.	16	18

CO3: Suggest special welding process of given application.			
3	**3. Other Welding Processes** 3.1 Principle, Working, Advantages, Limitations and Applications of : a) Resistance Welding – Spot welding & Seam welding, b) Thermit Welding, c) Cold Welding, d) Electro-slag Welding, e) Explosion Welding, f) Friction Welding, g) Electron Beam Welding, h) Laser Beam Welding.	08	10

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4 : Draw welds positions, weld joint design and microstructure of Heat Affected Zone			
4	4. **Metal Transformation of Welding** 4.1 Heat Affected Zone (HAZ). 4.2 Structure of welded joint. 4.3 Pre and post heat treatment of welding. 4.4 Metallurgical changes occur in welding.	06	08
CO5 : Compare soldering with brazing			
5	5. **Soldering & Brazing** 5.1 Brazing: Principle, Procedure, Filler metals, Brazing Fluxes – Functions and Requirements, Advantages, Limitations, Applications, Brazing processes. 5.2 Soldering: Principle, Solders, Fluxes, Requirements of Soldering, Advantages, Limitations, Applications, Soldering Methods.	10	12
CO6 : Suggest suitable remedies for various welding defects and perform various destructive and non-destructive tests on welded parts			
6	**6. Welding Defects and Testing of Welds** 6.1 Causes & Remedies of Weld Defects – a) Cracks, b) Distortion, c) Incomplete penetration, d) Inclusions, e) Porosity and Blow holes, f) Undercutting, g) Overlapping. 6.2 Inspection of welded structures. Weld Tests – Destructive testing, Non-Destructive Tests.	14	16

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

G. List of Assignments under SLA –

Sr.No.	List of Assignments under SLA	Hrs. Alloted
1	Collect the detail data of any one new welding process.	5
2	Prepare report on Defects– definition, causes & remedies for any one welding process.	5
3	Prepare a poster on comparison of welding, brazing and soldering.	5
4	Prepare a report on radiant energy welding processes.	5
5	Prepare a report on destructive tests on welded parts.	5
6	Prepare a report on non-destructive tests on welded parts.	5

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	2	2	2	06	1
I / 2	Welding Methods	4	6	8	18	2
I / 3	Other Welding Processes	2	4	4	10	3
II /4	Metal Transformation of Welding	2	4	2	08	4
II /5	Soldering & Brazing	2	4	6	12	5
II / 6	Welding Defects and Testing of Welds	2	6	8	16	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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Welding Technology	O.P. Khanna	Dhanpat Rai Publications
2	Welding technology	Little, Richard L.	McGraw-Hill
3	Welding Technology	N.K. Shrinivasan	Khanna Publishers
4	Welding, Brazing, and Soldering	ASM Handbook, Volume 6	----

M. Learning Website & Software

1. https://www.youtube.com/watch?v=lNMJA2f_Fpk
2. https://www.youtube.com/watch?v=AkzXYiLg2WI
3. https://www.youtube.com/watch?v=slAwIfM2kJY
4. https://www.youtube.com/watch?v=NMeLI7iyDlw

***

COURSE ID :
COURSE NAME : Extraction of Nonferrous Metals
COURSE CODE : MTH407
COURSE ABBREVIATION : HENF

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	2
	Tutorial Learning	-	
	Laboratory Learning	-	
	SLH-Self Learning	-	
	NLH- Notional Learning	4	

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	--	--	-	--	--	--	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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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 course provides information about mineral dressing, extraction of nonferrous metals, and refining thereafter for various metals, which will be useful for effective management in industry. The basic principles and methods involved in extraction and refining of non-ferrous metals can be employed by students for engineering and commercial applications

ii) **INDUSTRY / EMPLOYER EXPECTED OUTCOME**

Understand the extraction of nonferrous metals.

E. COURSE LEVEL LEARNING OUTCOMES(COS)

1. Select Pyro metallurgical, Hydrometallurgical methods of extraction of Non-ferrous metals and ore dressing process for extraction of metal.
2. Understand stepwise extraction process of copper from its ores.
3. Understand stepwise extraction process of extraction of Titanium and lithium.
4. Understand stepwise extraction process of Zinc.
5. Understand stepwise extraction process Aluminum.
6. Understand stepwise extraction process of of Tungsten

Competency, course outcomes and programme outcomes /programme specific 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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO1- Choose extraction and ore dressing process.	3	3	2	2	2	2	2	3	3	2
CO2- Understand stepwise extraction process of copper.	3	3	2	3	2	3	2	2	3	3
CO3- Understand stepwise extraction process of Titanium and lithium.	3	3	2	3	2	2	2	2	3	3

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO4- Understand stepwise extraction process and refining of Zinc	3	3	2	2	3	2	2	2	2	2
CO5- Understand stepwise extraction and refining process Aluminum.	3	3	2	2	2	2	2	3	3	2
CO6- Understand stepwise extraction Tungsten	3	3	2	2	3	2	2	2	3	3

F. CONTENT

Course Content:

Section I

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
MTH 304-1 Select extraction and ore dressing process			
1.	**Ore Dressing** 1.1 Definitions: Ore, gangue, concentrate etc. 1.2 Introduction to Pyrometallurgy, Hydrometallurgy and Electrometallurgy. 1.3 General sequence of operations involved in extraction of metals from their ores. 1.4 Comminution: Crushing and grinding with jaw crusher, cone crusher, gyratory crusher and ball mill. Classification, jigging, tabling, floatation, magnetic separation, electrostatic separation	10	10
MTH 304-2- Understand stepwise extraction process of copper			

Sr. no	Topics/ Subtopics	Learning (Hours)	Classsroom learning Evaluation (Marks)
2.	**Extraction of Copper** 2.1 Properties and uses of copper 2.2 Ores/minerals of copper - oxides, sulphide and native copper. Ore dressing processes to obtain concentrate particularly from sulphide ores, current status of copper production in India 2.3 Production of copper by Pyrometallurgy - production flow sheet (by conventional and newer route) , stages of Pyrometallurgy 2.4 Flash smelting of copper. 2.5 Refining of Copper- fire and electrolytic refining Hydrometallurgy of copper- ferric chloride leaching of copper ore, advantages and disadvantages OFHC copper and its applications	12	14
MTH 304-3- Understand stepwise extraction process of Titanium and lithium			
3	**Extraction of Titanium and Lithium** 3.1 Properties and uses of Titanium. 3.2 Ores/minerals of Titanium and preparation of ore 3.3 Extraction of Titanium: Flowsheet – Kroll's process, Magnesium reduction, Refining by Van Arkell's process. 3.4 Properties and uses of Lithium. Extraction of Lithium - Minerals of Lithium, Preparation of Lithium Chloride, Electrolysis of Lithium Chloride	08	10
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 Subtopics	Teaching (Hours)	Theory evaluation Marks
MTH 304-4- Understand stepwise extraction process of Zinc.			
4	**Extraction of Zinc**. 4.1 Properties and uses of Zinc 4.2 Ores/minerals of Zinc, 4.3 Roasting of zinc concentrates. Suspension roasting and Fluidized-bed roasting processes., current status of zinc production in India 4.4 Pyrometallurgical extraction of zinc with flow sheet Extraction of metallic zinc by distillation in	10	12

	horizontal and vertical retort. 4.5 Hydrometallurgical processes for zinc extraction. Flow sheets of various processes. Refining of Zn by liquation and redistillation		
MTH 304-5 Understand stepwise extraction process of Aluminum.			
5	**Extraction of Aluminum** 5.1 Properties and uses of Aluminium 5.2 Ores and Minerals of Aluminium 5.3 Bayers's Process-Flow Sheet, stages involved, factors affecting Bayers's process, reduction of Alumina 5.4 Preparation of Cryolite-Flow Sheet and description with reactions involved 5.5 Production of Metallic Aluminium by electrolysis, Construction and working of Aluminium reduction cells, Composition of Bath and its properties, The anode effect. Modern practices in the design of electrolytic processes.	12	14
MTH304-6- Understand stepwise extraction process of Gold, Silver &Tungsten			
6	**Extraction of Gold, Silver and Tungsten** 6.1 Gold extraction in India. Flow sheet of Kolar gold fields operation in India. 6.2 Extraction of silver by Parke's process. 6.3 Extraction of Tungsten Sources of tungsten. Concentration of ores. Treatments to wolframite and scheelite concentrates. Production of tungsten powder and ductile tungsten. .	08	10
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.			

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

G : List of Assignments under SLA - NA

1. Locate nonferrous extraction plants operating in India by using internet.
2. Search for the information on the import of Cu metal in India. Understand the challenges of Cu ore extraction in India.
3. Familiarize with increasing applications of Titanium metal in engineering industry.
4. Explore the uses of Lithium in EV batteries. Study the recycling of lithium batteries.
5. Study the Aluminium recycling market in India.
6. Check the importance of Jewellery manufacturing industry in India

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	Application		
1	Ore Dressing	**4**	**4**	**2**	**1**	**10**
2	Extraction of Copper	**4**	**6**	**4**	**2**	**14**
3	Extraction of Titanium and Lithium	**2**	**4**	**4**	**3**	**10**
4	Extraction of Zinc	**4**	**4**	**4**	**4**	**12**
5	Extraction of Aluminum	**4**	**4**	**6**	**5**	**14**
6	Extraction of Tungsten	**2**	**4**	**4**	**6**	**10**
TOTAL		20	26	24		70

I :-Assessment Criteria - NA

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**

J) Instructional Methods:

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

Text-Books:

Sr. No.	Author	Title	Publisher
1.	K. S. Roy, R. Sridhar & K.P. Abraham.	Extraction of Non-Ferrous Metals	Affiliated East-west Press Pvt Ltd , 2008
2.	Roger Rumbu	Non-ferrous Extractive Metallurgy - Industrial Practices: Industrial Practices: 1 (Non-Ferrous Metallurgy)	CreateSpace Independent Publishing Platform , September 2014
3.	A.M. Gaudin	Mineral dressing	McGraw-Hill Inc.,US, December 1939

a) Websites

1. http://nptel.ac.in/courses/113105021
2. https://youtu.be/KBPv2p7T1wo
3. https://youtu.be/eGdXxFjqFsg
4. https://youtu.be/EPOIAevJUNM

***

COURSE NAME : Environment Protection in Metallurgical Industries
COURSE CODE : MTH502
COURSE ABBREVIATION : HEPMI

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	3
	Tutorial Learning	--	
	Laboratory Learning	2	
	SLH-Self Learning	--	
	NLH- Notional Learning	6	

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	--	--	150

(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, *# On Line Examination , @$ Internal Online Examination Note : (TNR 11 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)

Rationale:

Pollution of air, water, etc. has become a great problem and headache to all human beings and nature due to more and more Industrializations. The subject aims at providing students the knowledge of Pollutions, various pollutants, their effects, sampling & analysis, pollution control techniques, emission standards etc. This knowledge is essentially required for technicians to look after the pollution control acts requirement & operation of pollution control systems for cleans environments.

ii)**INDUSTRY / EMPLOYER EXPECTED OUTCOME**

Familiarize with the entire manufacturing process of casting.

E. COURSE LEVEL LEARNING OUTCOMES(COS)

1. Apply environment control acts & Industrial Act. Use environmental impact assessment and auditing.
2. Identify nature and sources of air pollutants and recommendations to reduce them.
3. Familiar with sources, effects and prevention of noise pollution.
4. Understood global pollution due to greenhouse effect, acid rain, photochemical smog, ozone depletion.
5. Identity hazardous waste and its reclamation.
6. Familiar with and effects of thermal and radiation pollution and its treatment and disposal.

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 knowledge	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO1 Role of Metallurgist**	**PSO2 Safety and cleanliness**	**PSO3 Recycling**
CO1	3	3	2	3	2	3	2	2	2	2	3	3	2
CO2	3	3	2	3	2	3	2	2	2	2	2	3	3
CO3	3	3	3	2	2	3	2	2	2	2	2	3	3
CO4	3	3	2	2	3	3	2	2	2	2	2	3	3
CO5	3	3	2	2	3	3	2	2	2	2	2	3	3
CO6	3	3	2	2	3	3	2	2	2	2	2	3	3

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 experiences	CO
1	Estimation of suspended particulate matter in air by high volume sampler.	1
2	Analysis of carbon monoxide, carbon dioxide, sulfur dioxide by Orsat's analysis.	2
3	Determination of turbidity of given effluent sample.	3
4	Determination of total solids, total suspended solids, total dissolved solids of given effluent sample.	4
5	Determination of acidity/ alkalinity in given effluent sample	5
6	Visit the industry & prepare a report on pollution control devices & equipments. Prepare an environment impact assessment report for any organic industry.	6

Section I

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory Evaluation Marks
1-Apply environment control acts& Industrial Act &monitoring by Use of environmental impact assessment and auditing.			
1	**Introduction** Environment. Classification of pollution & pollutants. Environment & pollution control Acts. Industrial Act & It's Regulation **Environmental Impact Assessment and Auditing** Environmental impact assessment. Environmental audit	**12**	**10**
2 Identify nature and sources of air pollutants and recommendations to reduce them.			
2	**Air Pollution in foundries** General characteristic of harmful waste gases and Dust Evolved Amount of Dust Evolved in Department for Preparation of molding sands in steel foundries. Generation of Dust in Department for Removal of casting from moulds in Steel Foundries. Amount of Dust generated when finishing steel casting Amount of Harmful gases Evolved in Steel Foundries. Amount of Process Gases Evolved when Pouring Cast Iron in to moulds.Amount of Harmful substances evolved when Drying Moulds and Cores in Iron foundries. Amount Of Dust exhausted with air in Iron Foundries Conclusions and recommendations for reducing air pollution. **Air Pollution in Rolling Mills**	**12**	**14**

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory Evaluation Marks
	Process Gases Evolved in Hot rolling Mills. Non-Process Gases and Dust evolved in Hot Rolling Mills. Process Waste gases and dust evolved in shops where the metal is Fire trimmed. Harmful substances Evolved in pickling baths of Pipe welding and sheet rolling plants Recommendations for estimating and Reducing air pollution.		
3 Identify sources, effects and prevention of noise pollution			
3	**Noise Pollution** Sources & effects of noise pollution. Measurement of noise pollution. Prevention & control of noise pollution. **Waste Water Treatment** Preliminary treatment, Primary treatment, Secondary treatment. Tertiary treatment. Sludge treatment & disposal	**08**	**10**
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 Subtopics	Teaching (Hours)	Theory evaluation Marks
4 Identify hazardous waste and its reclamation			
4	**Solid Waste Management.** Solid Waste: Classification of solid wastes. Ultimate disposal. Solid waste management. Methods of solid waste disposal. Reuse, Recycling & Recovery of materials from refuse Land filling, Phyto extraction, Use in construction Reclamation of synthetic sand in foundries-Wet and dry method Defining hazardous waste. Treatment & disposal of hazardous waste.	**10**	**12**
5 Familiar with sources and effects of thermal and radiation pollution and its treatment and disposal			
5	**Thermal Pollution and Radiation Pollution** Sources & effects of thermal and radiation pollution. Control measures of thermal pollution, Radiation exposure standard. Radiation protection. Treatment & disposal of radioactive waste	**10**	**10**
6 Understand importance of global pollution due to Greenhouse effect, acid rain, photochemical smog, ozone depletion.			
6	**Global Pollution** Green- house effect. Acid rain. Photochemical smog. Ozone depletion problem. Green hydrogen generation and storage methods, Applications Carbon footprint- Definition, Scope, Applications	**10**	**14**

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.

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

Section / Topic no.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total marks
		Remember	Understand	Application		
I/1	Introduction & Environment impact Assessment and Auditing	4	4	2	1	10
I/2	Air pollution in Metallurgical Industries	4	6	4	2	14
I/3	Noise pollution & Waste water treatment	4	4	2	3	10
II/4	Solid Waste Management	4	8	4	4	12
II/5	Thermal pollution and Radiation Pollution	2	4	4	5	10
II/6	Global pollution	4	4	4	6	14
	Total	20	32	18		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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Environmental Pollution Monitoring and Control	S.M. Khoplar	New Age International Publishers
2	Foundry Technology	O.P. Khanna	Dhanpat Rai Publications

*****

COURSE ID :
COURSE NAME : Non Metallic Materials
COURSE CODE : MTH503
COURSE ABBREVIATION : HNMM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	4	3
	Tutorial Learning	--	
	Laboratory Learning	2	
	SLH-Self Learning	--	
	NLH-Notional Learning	6	

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	--	--	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, *# On Line Examination , @$ Internal Online ExaminationNote : (TNR 11 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.

D. i) RATIONALE

The total developments in science and technology depend to a considerable extent on materials technology. The properties and applications of non-metallic materials has been a very important topic in engineering and technology. It is often said that the rate of growth of technology is hindered by the limited availability of materials with the desired properties. The field of non-metallic materials has assured for itself the responsibility to discover and control properties of materials for fundamental research and applications.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select a non metallic material for any given application.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

1. Select the polymer and adhesive based on the application and properties.
2. Identify different rubber grades for various engineering applications.
3. State the properties and structure of glasses.
4. State the characteristics of ceramics and insulating materials for various applications.
5. State the uses of lubricants and colloids based on their properties.
6. Select appropriate manufacturing method for different composite materials.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1: Select the polymer and adhesive based on the application and properties.	2	3	3	2	2	2	2	3	1	2
CO-2 : . Identify different rubber grades for various engineering applications.	2	2	2	1	2	2	3	3	1	2

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-3: State the properties and structure of glasses.	2	2	2	1	3	2	2	3	1	2
CO-4 State the characteristics of ceramics and insulating materials for various applications.	3	2	2	2	2	2	2	3	1	2
CO-5 : State the uses of lubricants and colloids based on their properties.	2	2	2	2	3	2	2	3	1	2
CO-6 : Select appropriate manufacturing method for different composite materials.	3	3	2	2	2	2	2	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 experiences	CO
1	Determine impact properties of polymers and composites by Izod impact test.	1
2	To observe and study various adhesive bond joints.	2
3	Measure the hardness of rubber and plastic using Shore (durometer) hardness tester.	2

Sr. no	Laboratory experiences	CO
4	To study characteristics of insulating materials.	4
5	To study the properties and engineering applications of glasses.	3
6	To study the properties and applications of ferrites.	2
7	To measure density of composites by Archimedes's principle.	4

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1:			
1	**Polymers & Adhesives:** 1.1 Introduction and definition of Polymer, Classification of Polymer on the basis of i) Molecular structure ii) monomers ii) Thermal behavior. 1.2 Concept of polymerization - Mechanism of polymerization, formations of polymers, structure of polymers, physical properties and chemical resistance. 1.3 Properties, applications, advantages and disadvantages of specific polymeric materials – poly – ethylene, resins, foamed plastics, wood, natural resins, PVC, acrylic polymers. 1.4 Adhesive: Definition, characteristics of adhesives, Adhesive bonding- mechanism and applications of adhesives. 1.5 Types of adhesives, use of adhesives, adhesive joints, advantages and disadvantages of adhesive bonding.	12	12
CO2: Identify different rubber grades for various engineering applications.			
2	**Rubbers :** 2.1 Rubber - Occurrence and structure, types of rubber. 2.2 Natural rubber and its property. 2.3 Natural rubber:- styrene, butadiene, butyl rubber, nitrile rubber important applications in the engineering industry. 2.4 Vulcanization of rubber, forming and fabrication techniques for rubber.	08	10

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
	2.5 Synthetic rubber, Synthesis, properties and uses of Buna-S Rubber, Buna-N Rubber, Neoprene Rubber. Differentiate between Natural rubber and Synthetic rubber.		
CO3: Apply knowledge of physical properties for selection of materials			
3	**Glasses:** 3.1 Glasses: Definition of glasses, Structure of glasses. 3.2 Glass production methods and processes. 3.3 Silicate structure- composition and properties. 3.4 Important types- Vitreous fused silica-polycrystalline glass, soda lime, applications. 3.5 Lead glass, borosilicate glass, glass ceramics, applications.	10	12

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4 : State the characteristics of ceramics and insulating materials for various applications.			
4	**Ceramics & Insulating Materials** : 4.1 Ceramics: Definition, types of ceramics, characteristics and applications. 4.2 Common oxides, clays, porcelain, insulating materials, abrasives, carbides, enamels, ceramic lubricants and steatites - Characteristics, advantages and disadvantages and applications. 4.3 Insulating materials -Definition, properties, applications and types of insulating materials. 4.4 Requirements of insulating materials, thermal, electrical and sound insulating materials. 4.5 Ferrites, soft magnetic materials and hard magnetic materials.	12	14
CO5 : State the uses of lubricants and colloids based on their properties.			
5	**Lubricants & Colloids :** 5.1 Lubricants: Definition, types and applications. 5.2 Theory of lubrication, Function and characteristics of lubricating oils.	08	10

	5.3 Organic liquids, synthetic lubricating oils– cutting fluids, lubricating greases, solid lubricants. 5.4 Define Colloids, Classification of colloids, intermediate systems, 5.5 Gels and pastes, clay-water dispersions and emulsions.		
CO6 : Select appropriate manufacturing method for different composite materials.			
6	**Composite Materials :** 6.1 Composite Materials -Definition, Introduction to composite materials, classification of composites. Advantages of Composite Materials and Structures. 6.2 Applications of Composite materials in the Present world, Mechanical behavior of Composite Materials. 6.3 Manufacturing processes-FRP composite, protective coating on composites. 6.4 Manufacturing of advanced composite materials – Contact moulding, mould preparation, spray-up , hand lay-up 6.5 Compression moulding methods - Matched die moulding, forming methods employing gas pressure, pultrusion, Filament winding.	10	12

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	Polymers & Adhesives	6	4	2	12	1
I / 2	Rubbers	6	2	2	10	2
I / 3	Glasses	6	2	4	12	3
II /4	Ceramics & Insulating Materials	6	2	4	14	4
II /5	Lubricants & Colloids	6	2	2	10	5
II / 6	Composite Materials	4	2	6	12	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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Nature and Properties of Engineering Materials	Zbigniew D. Jastrzebski	Toppan Printing Company Limited Japan, John Wiley & Sons Inc,
2	Elements of Material Science	Lawerence H. Van Vlack	Addison-Wesley Pub. Co
3	Advanced Mechanics of Composite Materials and Structures	Vasiliev, Valery V., Morozov, Evgeny V.	Publisher: Elsevier

M. Learning Website & Software

1. https://www.youtube.com/8Wn0Yacth2E
2 https://nptel.ac.in/courses/112/104/112104221/
3. https://freevideolectures.com/course/4483/nptel-introduction-materials-science-engineering/105

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COURSE ID :
COURSE NAME : Advanced Physical Metallurgy
COURSE CODE : MTH504
COURSE ABBREVIATION : HAPM

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	04	03
	Tutorial Learning	--	
	Laboratory Learning	02	
	SLH-Self Learning	--	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	30	70	100	40	25	10	25@	10	--	--	150

(Total IKS Hrs for Sem. : Nil)

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 ExaminationNote : (TNR 11 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.

D. i) RATIONALE

Metallurgical engineers often have to work in heat treatment shops or in design department to select a suitable material for required working condition. This subject deals with relationship between properties and selection of materials for such properties. This requires detailed knowledge of Physical Metallurgy, so this course will be suitable to specialize in study of material properties and their applications.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select suitable alloy steel as per the required properties and applications**.**

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Enlist and explain various methods of X-ray diffraction.
2. Correlate the effects of alloying elements on the properties and microstructures of steels.
3. Select suitable alloy steel for particular application (electrical, magnetic, machinability and wear resistance).
4. Select suitable stainless steel for given application.
5. Select suitable tool steel for given application.
6. Explain the diffusion mechanism with examples.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Enlist and explain various methods of X-ray diffraction.	3	1	1	2	1	2	1	3	1	1
CO-2 : Correlate the effects of alloying elements on the properties and microstructures of steels.	3	2	2	2	--	--	--	3	--	--
CO-3 : Select suitable alloy steel	3	3	3	3	1	2	2	3	1	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
for particular application (electrical, magnetic, machinability and wear resistance).										
CO-4 : Select suitable stainless steel for given application	3	2	2	2	1	2	1	3	1	1
CO-5 : Select suitable tool steel for given application	3	2	2	2	1	2	1	3	1	1
CO-6 : Explain the diffusion mechanism with examples.	3	3	2	2	--	1	2	3	--	--

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 experiences	CO
1	Study of Electron microscope	1
2	Study of alloying elements in steels	2
3	Study the effect of alloying elements on steels.	2
4	Study of machinability.	3
5	Determination of wear-resistance of metal.	3
6	Study of stainless steels.	4
7	Study of Tool steels.	4

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Enlist and explain various methods of X-ray diffraction			
1	**1. X-Ray Diffraction:** 1.1 X-rays: Principle of production, their properties and applications. 1.2 Bragg's law of X-ray diffraction, X-ray diffraction methods: Lauve method, rotating crystal method, powder method, calculation of lattice parameter. 1.3 Introduction to Electron microscope, differentiate between Electron and Optical microscope.	06	06
CO2: Correlate the effects of alloying elements on the properties and microstructures of steels			
2	**2. Alloy Steels :** 2.1 Classification of alloying elements: (a) Austenite and Ferrite stabilizers, (b) Carbide forming, graphitizing, neutral elements. 2.2 Role of different alloying elements in steel. 2.3 Effect of alloying elements on Iron-Carbon equilibrium diagram. 2.4 Effect of alloying elements on T.T.T. diagram of steels. 2.5 Effect on the grain growth, corrosion resistance and mechanical properties of steels. 2.6 Properties, compositions and applications of some engineering alloy steels and other alloys like- Free cutting, maraging, dual phase steels, high temperature alloys, low expansion alloys, alloys for heating elements. 2.7 Introduction to micro alloyed steels.	16	18
CO3: Select suitable alloy steel for particular application (electrical, magnetic, machinability and wear resistance).			
3	**3. Physical Properties & Selection of Materials for Various Applications :** 3.1 Electrical properties: Conductivity and resistivity, selection of materials for electrical applications. 3.2 Magnetic properties: Ferromagnetism, paramagnetism and diamagnetism, selection of materials for magnetic applications. 3.3 Machinability: concept of machinability, measurement of machinability, machinability index of various metals and alloys. 3.4 Wear resistance, types of wear: Adhesive, abrasive, erosion, dry, lubricated. Selection of materials for higher wear resistance.	08	10

Section –II

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO4 : Select suitable stainless steel for given application			
4	**4. High Temperature Properties, Corrosion Resistance & Stainless Steels :** 4.1 High temperature properties. Creep, creep resistant steels, super alloys, selection of materials for use at elevated temperatures. 4.2 Chromium steels, role of chromium in stainless steels. 4.3 Classification of stainless steels, properties, compositions and applications of different stainless steels. 4.4 Duplex stainless steels 4.5 Carbide precipitation in stainless steels, stabilization treatment.	12	14
CO5 : Select suitable tool steel for given application			
5	**5. Tools Steels :** 5.1 Tools steels, classification of tool steels, properties, compositions and applications of different tool steels. 5.2 Heat treatments of different tool steels: cold and hot working dies, cutting tools. 5.3 Spring steels: Properties, compositions, and heat treatments. 5.4 Introduction to PVD and CVD: Process, parameters, stages, applications, advantages and limitations.	10	12
CO6 : Explain the diffusion mechanism with examples			
6	**6. Diffusion in Metals :** 6.1 Diffusion, conditions required for diffusion, mechanisms of diffusion: Vacancy, interstitial, interstitialcy and ring. 6.2 Fick's first law. 6.3 Growth of oxide layer in metals. 6.4 Carburizing- variables that influence diffusion; temperature, concentration, crystal structure, impurities, grain size.	08	10

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

G. List of Assignments 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	X-Ray Diffraction	2	2	2	06	1
I / 2	Alloy Steels	4	6	8	18	2
I / 3	Physical Properties & Selection of Materials for Various Applications	2	4	4	10	3
II /4	High Temperature Properties, Corrosion Resistance & Stainless Steels	2	4	8	14	4
II /5	Tools Steels	2	4	6	12	5
II / 6	Diffusion in Metals	2	4	4	10	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**

J. Instructional Methods:

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

4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Physical Metallurgy Principles	Robert E. Reed-Hill	Affiliated East-West Press
2	Physical Metallurgy for Engineers	D.S.Clark	CBS Publishers and Distributors
3	Introduction to Physical Metallurgy	Sydney H. Avner	Tata McGraw Hill Publishing Company Ltd, New Delhi.,

M. Learning Website & Software

1. www.nptel.com-http://www.nptelvideos.in/2012/12/principles-of-physical metallurgy.html
2. Virtual Lab-http://mrmsmtbs-iitk.vlabs.ac.in/creep.htm

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COURSE ID :
COURSE NAME : CASTING SIMULATION
COURSE CODE : MTH505
COURSE ABBREVIATION : HCS

A. LEARNING SCHEME:

Scheme component		Hours	Credits
Actual Contact Hours / week	Classroom Learning	02	03
	Tutorial Learning	--	
	Laboratory Learning	04	
	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	MAX	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
03	--	--	--	--	50	20	50@	20	--	--	100

(Total IKS Hrs for Sem. : Nil)

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 ExaminationNote : (TNR 11 font)

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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

Technically 3 dimensions refers to objects that are constructed on 3 planes (X,Y,Z). The process of creating 3 dimensional (3D) computer graphics can be divided into 3 basic phases - 3D modeling, 3D animation & 3D rendering. 3D models usually originate on the computer by engineers using some kind of solid modeling softwares. Solid modeling is a process of developing a mathematical representation of any 3 dimensional object. The solid model may be created using solid modeling softwares. Solid models are often animated for some uses. Today 3D models are used in a wide variety of engineering fields. Three dimensional computer graphics are widely used for product design, assembly design etc. As a diploma engineer he should have the knowledge of solid modeling software to visualize the machine components & assembly like cars, machine tools and earth movers etc.

ii) INDUSTRY / EMPLOYER EXPECTED OUTCOME

Understanding and applying modeling software in engineering field.

E. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to**:**

1. Use and apply 3D Solid model input format.
2. Analyze part thickness of Analysis temperature profile.
3. Apply Methods Layout.
4. Apply use cavity layouts Know Feeder design and solidification simulation.
5. Apply cost on design layout.

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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-1 : Use and apply 3D Solid model input format	2	2	3	3	2	2	3	1	1	1
CO-2 : Analyze part thickness of Analysis temperature profile	2	2	3	3	1	3	3	1	--	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 Society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO1 The role of metallurgist in industries**	**PSO2 To create awareness about safety protocols**	**PSO3 Develop sensitivity about the environmental hazards**
CO-3 : Apply Methods Layout	1	2	2	2	2	2	2	1	1	2
CO-4 : Apply use cavity layouts Know Feeder design and solidification simulation	2	2	3	2	2	2	2	1	2	1
CO-5 : Apply cost on design layout.	2	2	2	2	2	2	2	1	2	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 experiences	CO
1	Creation of Production Drawings	1
2	Part modeling and geometry analysis	2
3	Feeder design, Gating design and mold filling simulation	2,3,4
4	Casting cost estimation	4
5	Case studies	4

II) Theory

Section I

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
CO1: Use and apply 3D Solid model input format			

Sr. no.	Topics/Subtopics	Learning (Hours)	Classroom learning evaluation Marks
1	**1. Part modeling and geometry analysis** The objective of this exercise is to create a 3D CAD model of a given part, compute its geometric properties, analyze its thickness and shape complexity. All these affect tooling design, manufacture, quality and cost.	08	06
CO2: Analyze part thickness of Analysis temperature profile			
2	**2. Mold cavity layout** The objective of this exercise is to determine the correct combination of mold box and number of cavities to achieve the desired ratio of cast metal to mold material. A low ratio leads to poor utilization of production resources, whereas a high ratio leads to poor quality	18	16
CO3: Apply Methods Layout			
3	**3. Feeder design and solidification simulation** The objective of this exercise is to design, model and verify the feeding system design for the given casting, to obtain a casting free of solidification shrinkage defects along with the highest possible yield	12	10
CO4 : Apply use cavity layouts Know Feeder design and solidification simulation			
4	**4. Gating design and mold filling simulation** The objective of this exercise is to design, model and verify the gating channel design for the given casting, to achieve smooth, complete and uniform filling of the mold cavity.	10	08
CO5 : Apply cost on design layout.			
5	**5. Casting cost estimation** The objective of this exercise is to estimate the cost of a casting, and to study the effect of various factors on total cost.	12	10

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

G. List of Assignments under SLA – NA

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 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**

J. Instructional Methods:

1. Lectures cum Demonstrations,
2. Class room practices.
3. Use of projector and soft material for demonstration.
4. Laboratory experiences and laboratory interactive sessions.
5. Regular home assignment.

K. Teaching and Learning resources:

Chalk board, LCD presentations, Demonstrative charts.

L. Reference Books:

S.N.	Name of Book	Author	Publication
1	Sham Tickoo	CATIA V5R17 for Designers Softcover, Cadcim T	Softcover, Cadcim Technologies
2	Sham Tickoo	Pro/Engineer Wildfire for Designers	Softcover, Cadcim Technologies
3	Sham Tickoo	SolidWorks For Designers Release 2006	Softcover, Cadcim Technologies

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