

GOVERNMENT POLYTECHNIC, KOLHAPUR

(An Autonomous Institute of Government of Maharashtra)

Curriculum Document

CURRICULUM : MPECS-2016

(Outcome Based Curriculum) for DIPLOMA INMETALLURGY (FOUNDRY)

Priya Jadhav Secretary Shashank Mandre Chairman

Programmewise Board of Studies (PBOS) Metallurgy(Foundry)Programme Government Polytechnic, Kolhapur

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$\boldsymbol{SECTION-I}$

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

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

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

• To define the purpose of education

- To accept systematic planning methods
- To confirm implementation strategies
- To identify and to incorporate needs of industries
- To follow the policy directives
- To cope-up with social concerns
- To aim at personality development of students
- To allow future developments and challenges in emerging science and technology.

Outcome-based Curriculum

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

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

OUTCOME BASED EDUCATION SYSTEM



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Remembering > Understanding > Applying > Analyzing > Evaluating > Creating

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

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

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

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

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

Receiving > Responding > Valuing > Organizing > Characterizing

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

Glossary of terms used in Academic Autonomy and MPECS

Academic Autonomy – It is the freedom and responsibility offered to the Institute by the Government to attain high quality standards in the following three dimensions :

i) Design of own curricula ii) Conduct of own examinations iii) Award of own diploma

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

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

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

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

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

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

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

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

Curriculum MPECS-2016 - It is the Curriculum of the Institute revised in the year 2016. It is applicable to the students admitted since 2016

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 CommitteeCurriculum Revisions under Autonomy : 1992, MPECS-2001, MPECS-2006, MPECS-2010, MPECS-2013, MPECS-2016
- Award of Diploma in Convocation Ceremony every year

Curriculum Development Model :



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

Vision of Institute:

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

Mission of Institute:

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

Vision of Programme:

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

Mission of Programme:

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

Programme Educational Objectives(PEOs):

- 1. To establish 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.

Programme Outcomes (POs):

- 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Metallurgical engineering problems.
- 2. Discipline knowledge: Apply Metallurgical engineering knowledge to solve problems in Metallurgical industries.
- 3. Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Metallurgical engineering problems.

- 4. Engineering tools: Apply relevant Metallurgical technologies and tools with an understanding of the limitations.
- 5. The engineer and society: Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practices in field of Metallurgical engineering.
- 6. Environment and sustainability: Apply Metallurgical engineering solutions for sustainable development practices in societal and environmental contexts.
- 7. Ethics: Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice in the field of Metallurgical engineering.
- 8. Individual and team work: Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- 9. Communication: Communicate effectively in oral and written form.
- 10. Life-long learning: Engage in independent and life-long learning activities in the context of technological changes in the Metallurgical engineering and allied industry.

Programme Specific Outcomes (PSOs)

- 1. To prepare the students to play the role of metallurgist in industries.
- 2. To create awareness about safety protocol 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.

Job profiles and related Competencies for the diploma holder

- 1. Process control supervisor/Engineer-
- 2. Production Supervisor/Engineer-
- 3. Quality Control supervisor/Engineer-
- 4. Laboratory In charge
- 5. Stores Incharge
- 6. Management Information System representative
- 7. Sales/Purchase executive

3. OVERVIEW AND SALIENT FEATURES OF CURRICULUM: MPECS-2016

Total N	<u>lo. o</u>	f Credits	180				
No. of		Total	35				
courses	S I	Theory	26				
Mox n							
Max. III	J. CO	uises III a	7				
Total Me	avim	um Marks	4400				
Courses	in	No	11				
Level IV	and	Credits	74				
V	una	Marks	1600				
		No.	10				
Courses	in	Credits	45				
Level	Ι	Marks	1050				
0	•	No.	3				
Courses	in T	Credits	11				
Level	1	Marks	250				
G		No.	11				
Courses	1n	Credits	50				
Level I	11	Marks	1475				
C	•	No.	8				
L ourses	1n V	Credits	60				
Level I	V	Marks	1225				
Courses	in	No.	3				
Lovel	111 7	Credits	14				
Level	v	Marks	400				
%Ratio of	N	Marks-wise	60:40				
Th:Pr	(Credit-wise	45:55				
No. of A	Allied	d Courses	2				
Optional	No.	of courses	5				
Courses	Opt	tions/course	3				
No. of	1	Internal	9				
Practica Exams	LI	External	3				
No of O		Internal	4				
No. of Orals		External	6				

3.1 Overview of Curriculum MPECS-2016

Diploma shall be awarded on the basis of marks obtained in Level IV and Level V courses

3.2 Salient Features of Curriculum MPECS-2016

Addition and deletion of Courses with respect to MPECS-2013:

Five courses are deleted. Two groups of optional courses are deleted **In-plant training is introduced for the vth semester**

Major modifications in Course Contents with respect to MPECS-2013:

- 1) Courses such as Project (MTE 407), Seminar (MTE 404) to be included in Semester V, however completion of project may be allowed by the end of the semester VI. It will retain the focus on the inplant training
- 2) Courses such as Fuels, Refractories Pyrometry& Furnace Technology to be merged & new course with title Furnaces, Refractories & Pyrometry(MTE 408) should be designed. The rotary furnace, oil furnace should be extruded from the content since it is outdated.
- 3) Management courses namely Industrial Organization & Management (IOM), Quality Management (QM), Industrial Engineering (IE) to be merged & new course with title 'Business Management' (MTE 502) should be introduced. Business Management should include essential and necessary contents of all three courses.
- 4) Ferrous & Non-Ferrous extractive metallurgy to be merged & integrated course to be designed namely Extractive Metallurgy(MTE304) .Extraction of non-Ferrous metals such as Aluminium (Al) &Copper (Cu) should be included along with iron and steel making. Extraction of other metals such as Zn, Sn, Sband nuclear metals are not necessary and should be deleted. However, introduction of precious metals such asTitanium, Silver & Gold should be included.
- Course such as 3D modelling & Casting Simulation to be merged & new integrated course of 3Dmodeling & casting simulation (MTE501) should be introduced. The content should remain same and students should be allowed to practice more hours on the working Saturdays.
- 6) Advance Physical metallurgy course to be removed since there is overlapping of content with the course Failure Analysis and Selection of Materials. The content such as diffusion, diffraction in Advance physical metallurgy course is not required for diploma level students, hence it should be deleted.
- 7) It was observed that casting defects content is absent in foundry technology courses, hence it should be added in foundry technology II course.
- 8) Electives offered under MPEC 2013 should be reduced from 4 groups to 2 groups & they should be offered in Sem VI.

Changes in Implementation Strategy and Treatmentwith respect to MPECS-2013:

POs,PEOs,COs are defined and accordingly content is designed

4. TEACHING AND EXAMINATION SCHEME (LEVEL-WISE)

Prac/ Drg./ Tut 2 2 1 4	Cr 6 6	Th	тѕ			Examination Scheme (Marks)				
Dig./ Tut 2 2 1 1 4	6 6		15	TW	Pr	Or				
2 2 1 1 4	6 6			1 **	11	01				
2 2 1 1 4	6 6									
2 1 1 4	6	80	20	-	50	-				
1 1 4		80	20	-	50	-				
1 4	4	80	20	-	-	-				
4	4	80	20	-	-	-				
	6	80	20	25	-	-				
4	6	80	20	25	-	-				
2	6	80	20	25	-	-				
2	2	-	-	50	-	-				
2	2	-	-	50	-	-				
2	3	-	-	25	50	-				
22	45									
2	4	-	-	25	50	-				
2	4	40	10	-	25	-				
2	3	-	-	50	-	50				
0	11									
1	4	80	20	25	-	-				
2	5	80	20	-	25**	25**				
2	5	80	20	25	25*					
1	4	80	20	25						
2	5	80	20	25	-	25*				
2	5	80	20	25	25					
2	5	80	20	-	25**	25**				
2	5	80	20	25	25*					
2	5	80	20	25		-				
2	5	80	20	25	-	25*				
2	2	-	-	25		25*				
20	50									
2	5	80	20	25		25**				
2	5	80	20	25	-	25**				
2	5	80	20	25	-	-				
2	5	80	20	25	-	-				
4	4	-	-	50	-	50**				
2	5	80	20	25	25**					
26	26	-	-	200	-	100**				
2	5	80	20	25	-					
2 26 2		26 5	26 - 5 80	3 80 20 26 - - 5 80 20	3 80 20 23 26 - - 200 5 80 20 25	3 80 20 23 23*** 26 - - 200 - 5 80 20 25 -				

	Level 5: Manageme	18	42	60									
33	3-D Modeling and Casting Simulation	MTF501	FMCS	5	NA		6	6	-	-	100	50	-
34	Elective-2 < MTF502 TO MTF504> Group B	-	-	5	NA	3	2	5	80	20	25	-	25
35	Elective-3 < MTF505, MTF506, CCF 501> Group C	-	-	5	NA	3	2	3	80	20		-	-

OPTIONAL COURSES FOR ELECTIVES

S N	Name of Course	Course Code	Cours e Abbre via- tion	Le vel	Pre- requi- site	Т 5 (h	eaching Scheme ours pe week)	Examination Scheme (marks)					
					e	Th	Pract. /Drg. /Tut.	Cr ed its	T h	T S	TW	Pr	Or
	Elective – 1(ANY ONE) Group A												
1	Non conventional energy sources	MTF408	FNCE	5	NA	3	2	5	80	20	25	-	-
2	Energy Conservation and audit	MTF409	FMDD	5	NA	3	2	5	80	20	25	-	-
3	Corrosion and protection methods	MTF410	FECE	5	NA	3	2	5	80	20	25	-	-
	Elective – 2 (ANY ONE) Group B												
4	Environment protection in metallurgical industries	MTF 502	FENP	4	NA	3	2	5	80	20	25	-	25
5	Non metallic materials	MTF 503	FNMM	4	NA	3	2	5	80	20	25	-	25
6	Characterization of metals	MTF504	FCHM	4	NA	3	2	5	80	20	25	-	25
	Elective – 3 (ANY ONE) Group C												
7	Industrial Management	MTF 505	FMMG	5	NA	3	-	3	80	20	-	-	-
8	Quality Management	MTF 506	FIND	5	NA	3	-	3	80	20	-	-	-
9	Industrial Organisation and Management.	CCF 501	FIOM	5	NA	3	-	3	80	20	-	-	-

5. PATH-WISE COURSE STRUCTURES Path-1 : Students admitted to First Year - X std. pass outs

S		Commo	Cours e	T.	Pre- requi-	Sc	Teaching heme (hou per week)	irs	I	Exam	inatio (Maı	n Sche rks)	me
N Name of Course		Code	Abbre via- tion	vel	site Cours e	Th	Pract. / Drg. / Tutori al	C re di ts	T h	T S	T W	Pr	Or
	Semester 1												
1	Generic Skills	CCF201	FGNS	2	NA	2	2	4		-	25	50	-
2	Engineering Physics	CCEF01	FPHA	1	NA	4	2	6	80	20	-	50	-
3	Basic Mathematics	CCF105	FBMT	1	NA	3	1	4	80	20	-	-	-
4	Engineering Drawing-I	CCF107	FEDA	1	NA	2	4	6	80	20	25	_	_
5	Applied Mechanics	CCF110	FADM	1	NA	4	2	6	80	20	25		
5	Workshop Practice I	CCF110	FUED	1		4	2	0	80	20	23	-	-
0	Semester 2	CCF112	FWSB	1	NA		2	2	-	-	50	-	-
7	Engineering Chemistry	CCE103	ЕСНА	1	NΔ	4	2	6	80	20	_	50	_
0	Engineering Mathematics	CCE10C	FEMT	1	CCE105	4	1	0	80	20	-	50	-
0	Engineering drawing-II	CCF106	FEMI	1	CCF105	3	1	4	80	20	-	-	-
9	Communication Skills	CCF108	FEDB	1	CCF107	2	4	6	80	20	25	-	-
10	Workshop Practice II	CCF202	FCMS	2	NA	2	2	4	40	10	-	25	-
11		CCF116	FWSF	1	CCF112	-	2	2	-	-	50	-	-
12	Computer Fundamentals	CCF 117	CFAS	1	NA	1	2	3	-	-	25	50	
	Semester 3							25					
13	Professional Practices	MTF 203	FPPR	2	NA	1	2	3	-	-	50	-	50
14	Metallurgical Thermodynamics	MTF 301	FMTH	3	NA	3	1	4	80	20	25	-	-
15	Metallurgical Analysis	MTF303	FMAN	3	NA	3	2	5	80	20	25	25	-
16	Foundry Technology I	MTF305	FFTH-I	3	NA	3	2	5	80	20	25	-	25*
17	Physical Metallurgy-I	MTF307	FPMT-I	3	NA	3	2	5	80	20	-	25**	25**
18	Mechanical Engineering	MTF308	FMEC	3	NA	3	2	5	80	20	25	25	-
19	Furnaces,, Refractories & Pyrometry	MTF 309	FFRP	3	NA	3	2.	5	80	20	25	-	_
	Semester 4						_	32					
20	Material Testing	MTF302	FMAT	3	NA	3	2	5	80	20	-	25**	25**
21	Extractive Metallurgy	MTF304	FEFM	3	NA	3	1	4	80	20	25		-
22	Electrical Engineering and Electronics	MTF306	FEEE	3	NA	3	2	5	80	20	25	25	-
23	Metal working processes	MTF310	FMWP	3	NA	3	2	5	80	20	25	-	25
24	Physical Metallurgy II	MTF401	FPMT-II	4	NA	3	2	5	80	20	25	-	25**
25	Foundry Technology II	MTF402	FFTH-II	4	NA	3	2	5	80	20	25	_	25**
26	Elective-1 < MTF408,MTF409,MTF410>	-	-	4	NA	3	2	5	80	20	25	-	-
	Semester 5			-			_	34					
27	In-plant Training	MTF407	FIPT	4	NA	-	26	26	-	-	200	-	100**
28	Seminar	MTF311	FSEM	3	NA	-	2	2	-	-	25	-	25*
20	Failure Analysis & selection of Materials	3.6777.10.0				_		28					
29	Powder Metallurgy	MTF403	FFSM	4	NA	3	2	5	80	20	25	-	-
30	Metal Joining & Special forming	MTF404	FPWM	4	NA	3	2	5	80	20	25	-	-
31	processes.	MTF406	FMJF	4	NA	3	2	5	80	20	25	25**	-
32	3-D Modelling and Casting Simulation	MTF501	FMCS	5	NA	-	6	6	-		100	50	-
33	Elective-2 < MTF502,MTF503,MTF504>	-	-	5	NA	3	2	5	80	20	25	-	25
34	Elective-3 < MTF505,MTF506,CCF501>	-	-	5	NA	3	-	3	80	20	-	-	-
35	Project	MTF405	FPJT	4	NA	-	4	4	-	-	50	-	50**

SECTION – II SYLLABI OF COURSES (LEVEL-WISE)

Government Polytechnic, Kolhapur

GOVERNMENT POLYTECHNIC, KOLHAPUR

MPECS 2016

DEPARTMENT OF METALLURGY

LEVEL 3

Sr No	Name of Course	Course Code
	Level 3: Basic Technology Courses	
1	Metallurgical Thermodynamics	MTF301
2	Material Testing	MTF302
3	Metallurgical Analysis	MTF303
4	Extractive Metallurgy	MTF304
5	Foundry Technology. I	MTF305
6	Electrical Engineering and Electronics	MTF306
7	Physical Metallurgy I	MTF307
8	Mechanical Engineering	MTF308
9	Furnaces, Refractories & Pyrometry	MTF309
10	Metal working processes	MTF310
11	Seminar	MTF311

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COURSE ID:

Course Name	: Metallurgical Thermodynamics
Course Code	: MTF 301
Course Abbreviation	: EMTH

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits		
Theory	3	4		
Tutorial/Term Work	1	4		

Evaluation Scheme:

Component	Progressive	Assessment	Semester end				
Component	Theory	Term work	Theory	Oral**			
Duration	Two tests (1hour	One practical	One paper				
	each)	(2hours)	(3 hours)				
Marks	Marks 20		80				

COURSE ID:

Course Code	Course Name	Course Abbreviation
MTF 301	Metallurgical Thermodynamics	EMTH

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.

COMPETENCY:

Knowledge of optimum utilization of energy in metallurgical processes.

Cognitive: Understanding thermodynamic laws with reference to metallurgical processes.

Psychomotor:

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) asthetic presentation

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

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

Course Outcomes:

MTF 301-1: Use fundamentals and terms to understand thermodynamic principles

MTF 301-2: Use first law of thermodynamics and Hess's law to understand thermodynamic reactions

MTF 301-3: Use second law of thermodynamics to understand thermodynamic reactions

MTF 301-4: Use third law of thermodynamics, Roult's law, Henry's law and sievert's law to understand thermodynamic reactions

MTF 301-5: Use Ellingham Diagram to predict the conditions under which an ore will be reduced to its metal.

	Programme Outcomes POs and PSOs												
Competency and Cos	PO 1 Basic know leddg e	PO 2 Disci pline know ledge	PO 3 Expe rime nts and pract	PO 4 Engi neeri ng Tools	PO5 The engi neer and soci ety	PO 6 Env.t and susta inabi lity	PO 7 Ethic s	PO8 Indi vidu al and team work	PO 9 Com mun icati on	PO 10 Life- long learn inge	PSO1 Role of Metal lurgis t	PSO2 Safet y and cleanl iness	PSO3 Recy cling
Competency: Knowledge of optimum utilization of energy in metallurgical processes.	3	3	3	2	2	3	2	2	3	3	3	2	3
MTF 301-1	3	3	2	2	2	2	2	2	2	2	3	3	2
MTF 301-2	3	3	2	3	2	3	2	2	2	2	2	3	3
MTF 301-3	3	3	2	3	2	2	2	2	2	2	2	3	3

Curriculum MPECS-2016 Diploma in Metallurgical Engineering (Foundry)

				Prog	ramm	e Outc	omes]	POs an	d PSC)s			
Competency and Cos	PO 1 Basic know leddg e	PO 2 Disci pline know ledge	PO 3 Expe rime nts and pract	PO 4 Engi neeri ng Tools	PO5 The engi neer and soci ety	PO 6 Env.t and susta inabi lity	PO 7 Ethic s	PO8 Indi vidu al and team work	PO 9 Com mun icati on	PO 10 Life- long learn inge	PSO1 Role of Metal lurgis t	PSO2 Safet y and cleanl iness	PSO3 Recy cling
MTF 301-4	3	3	2	2	3	2	2	2	2	2	2	2	2
MTF 301-5	3	3	2	2	2	2	2	2	2	2	3	3	2

CONTENTS :

A. THEORY:

Sr.	Topic / Subtopic	Hours	Marks
No.			
	Section I		
MTF	301 Use fundamentals and terms to understand thermodynamic principles		
1	INTRODUCTION: SCOPE, CONCEPTS AND TERMS OF THERMODYNAMICS. Definition of thermodynamics, scope of metallurgical thermodynamics. Energy- concepts , properties, forms, and sources of energy. Thermodynamic system and its classification. State of systems Extensive and insentive properties, equation of state. Thermodynamic processes: isobaric, isothermal, isochoric, adiabatic and	12	20
MTF	Thermodynamic equilibrium, reversible and irreversible processes 301 Use first law of thermodynamics and Hess's law to understand thermody	mamic react	tions
2	FIRST LAW OF THERMODYNAMICS Statements and formulation of first law of thermodynamics.	12	20
	Internal energy as a state property. Heat capacity: specific heat at constant volume and constant pressure, relation between Cp and Cv. Enthalpy : definition and mathematical expression Thermo -chemistry: exothermic and endothermic reactions. Hess's law – statement and significance. calculation based on Hess's law		

	Section II		
MTF	301 Use second law of thermodynamics to understand thermodynamic react	ions	
3	SECOND LAW OF THERMODYNAMICS	10	12
	Statement and mathematical expression of second law of		
	thermodynamics.		
	Concept of entropy, entropy change associated with thermodynamic		
	processes. Calculation of entropy of t he reaction.		
	Significance of entropy.		
	Combine statement of first and second law		
	Concept of Free energy,		
	Expression of Helmotz free energy and Gibbs free energy.		
	Change in free energy as criteria for deciding nature of process.		
	Fugacity and activity		
MTF	301 Use third law of thermodynamics ,Roult's law,Henry's law and sievert's	law to unde	erstand
therm	odynamic reactions		
4	THIRD LAW OF THREMODYNOMICS	10	16
	Statement of law and its significance.		
	Zeroth law of thermodynamics and its significance		
	Phase rule		
	Free energy-temperature relation and relative stability of phases.		
	Equilibrium constant for chemical reactions.		
	Ideal solution- activity coefficient, Roult's law and Henry's law,		
	Sievert's law and its significance		
MTF	301 Use Ellingham Diagram to predict the conditions under which an ore will	l be reduced	to its
metal.		•	
5	ELLINGHAM DIAGRAMS	04	12
	General form of Ellingham diagram.		
	Oxide and sulphides Ellingham diagrams.		
	Characteristics of Ellingham diagrams		
	Significance of diagrams- reduction and dissociation of oxides.		
	Intersecting lines on Ellingham diagrams.		

S.No.	Title of Tutorials/Assignments	Hrs.
1.	Numericals based on enthalpy calaculations	02
2.	Numericals based on entropy calculation	02
3.	Numericals based on free energy calculation	02
4.	Numericals based on specific heat capacities calculations	02
5.	Assignments on Ellingham diagrams	04
6.	Any assignments based on above curriculum.	04
	Total	16

ASSESSMENT OF LABORATORY EXPERIENCES/ASSIGNMENTS :

Continuous assessment of Term Work and Term end oral/ practical examination

SUGGESTED IMPLEMENTATION STRATEGIES :

- 1. Lecture method
- 2. Improved lecture method.
- 3. Q & A technique.
- 4. Demonstration
- 5. Case study
- 6. Seminars
- 7. Field visit

SUGGESTED LEARNING RESOURCES :

- 1. **PRINT :** Text books/Reference books/Manuals/Journals.
- 2. NON PRINT : CDs / PPT / Transperencies / Charts / Models

SPECIFICATION TABLE :

Chapter No	Title of Chapter	Marks	Rememb er	Distribution Understa nd	<u>n of Marks</u> Applicati on	Total
1.	Introduction	20	10	10		20
2.	First law of	20	05	10	05	20
3.	Second law of thermod.	12	04	04	04	12
4.	Third law of thermod.	16	02	04	10	16
5.	Ellingham diagrams	12	02	02	08	12
	Total	80				80

REFERENCE & TEXT 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	G. S. Upadhyaya, Publisher
	thermodynamics and kinetics	Pergamon, first edition

COURSE ID:

Course Name	: Material Testing
Course Code	: MTF 302
Course Abbreviation	: FMAT

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of	Progress	ive Assessment	Term End Exa		
Evaluation	Theory	Practical	Theory Examination	Oral	Total
Details of Evaluation	Average of two tests of 20 marks each	 i. 25marks for each practical ii. One PST of 25 marks 	Term End Theory Exam (3 hours)	As per proforma-VI	
Marks	20	25	80	25	150

RATIONALE:

Metallurgy is a science, which deals with materials and a study of their properties. Testing of materials is essential to control and co-relate various manufacturing parameters and also to decide suitability and predict probable behavior of materials in practice. Various common mechanical tests are studied which tell about the service performance of metals and how metallurgical variables affect the results of these tests.

COMPETENCY: Familiar with the mechanical properties and its testing procedure as well NDT procedures.

Cognitive: Understand the principle of various destructive and non-destructive tests.

Psychomotor: Conducting tensile, hardness, impact test procedures.

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

MTF 302-1 Use fundamentals of plastic deformation to interpret the results of mechanical testing.

MTF 302-2 Conduct tensile and compression tests and measure properties of alloy.

MTF 302-3 Use suitable hardness testing method to measure hardness.

MTF 302-4 Use impact test to determine impact strength of material.

MTF 302-5 Use fatigue test to determine fatigue properties of material.

MTF 302-6 Consider importance of creep while dealing with material used in high temperature conditions.

MTF 302-7 Select suitable non destructive test to analyze materials according to the requirements.

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

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

				Р	rogran	ıme Oı	itcome	s POs a	and PS	Os			
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 Engin eer and societ y	PO 6 Envir onme nt and sustai nabili ty	PO 7 Ethics	PO 8 Indivi dual and team work	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safety and cleanl iness	PSO3 Recycl ing
Competency: Familiar with the mechanical properties and its testing procedure as well NDT procedures.	3	3	1	1	2	3	2	2	3	3	3	2	3
MTF 302-1	3	3	1	2	2	2	2	2	2	2	3	3	-
MTF 302-2	3	3	2	3	-	3	1	2	2	2	2	3	3
MTF 302-3	3	3	2	3	2	1	2	2	2	2	2	3	3
MTF 302-4	3	3	2	2	3	2	2	1	2	2	2	2	2
MTF 302-5	3	3	2	2	2	2	2	2	2	2	3	3	2
MTF 302-6	3	3	2	2	3	2	2	2	2	2	2	3	3
MTF 302-7	3	3	2	2	3	2	2	2	2	2	2	3	3

COURSE CONTENT:

SECTION-I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MTF	302-1 Use fundamentals of plastic deformation to interpret the	results of me	chanical
testin	g.		
1	Elasticity Stress, Strain, definition of elastic and plastic bodies. Strain under axial load in tension and compression. Temperature stresses. Normal stress under axial load. Internal resisting stress, Numerical problems.		
	Hooke's Law, Relation between linear strain and normal stress. Modulus of elasticity Young's modulus.	08	16
	Shear stress, concept of shear load, shear strain – stress. Modulus of rigidity, Lateral strain-poission's ratio, changes in volume. Volumetric stress and strain. Bulk modulus and its relation with Young's modulus.		
MTF	302-2 Conduct tensile and compression tests and measure prop	erties of allo	y.
2	Tensile TestingTensile test: Scope and applicability, specification fortesting specimens, conduct and observations of test,effect of important variables, yield stress and proofstress determinations.Universal testing machine.Compression test of steel and cast Iron.	08	12
	Numerical based on Tensile and Compression Testing.		
MTF	302-3 Use suitable hardness testing method to measure hardness	55.	
3	Hardness Tests Scope and applicability. Constructional principals of common hardness machines. Brinell Test: Procedure, effect of variable. Rockwell	08	12

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MTF testin	302-1 Use fundamentals of plastic deformation to interpret the g.	results of me	echanical
	Test: Procedure, Rockwell superficial hardness tester. Vickers Hardness Test, Microhardness Tester, Shore Sclerescope, Knoop hardness test, scratches and wear hardness tests. Equotip hardness tests its application for measuring hardness of thin layer and hollow surfaces. Relation between various systems of hardness numbers. Relation of hardness to tensile strength. Testing of non- metallic materials.		

SECTION-II

Sr. No.	Topics / Sub-topics 302-4 Use impact test to determine impact strength of material.	Lectures (Hours)	Theory Evaluation (Marks)
4	Impact Test Impact test: Behavior of material under impact loading. Scope and application of test. Charpy and Izod Impact test. Calculate energy relation. Effect of important variables such as notch. Ductile, brittle fractures. Role of temperature and stress concentration factors like holes cracks etc.	06	08
MTF	302-5 Use fatigue test to determine fatigue properties of materia	al.	
5	Fatigue test:Repeated loading, Nature of fatigue in metal. Scope and applicability of fatigue test, machines for fatigue test on metals, General Procedures-N curve, Effect of important	06	10

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MTF	302-4 Use impact test to determine impact strength of material.		
	variables, correlation with other properties, Improvement of fatigue strength		
MTF condi	302-6 Consider importance of creep while dealing with materia itions.	l used in hig	h temperature
6	Creep Test:		
	Creep test: Nature of creep, Scope and applicability of creep test, Creep curve and its interpretation. Creep apparatus, Rupture test. Factors influencing creep.	04	08
MTF requi	302-7 Select suitable non destructive test to analyze materials a rements.	ccording to	the
7	Non-Destructive Testing: Need of non-destructive tests. Types of non-destructive tests.		
	Methods of examination of defects: Visual examination, penetrant test, hammers tests, Zyglo.		
	Methods of magnetic analysis: Magnetic particle method, Magnaflux, magnaglo.	08	14
	Methods of electrical analysis: Sperry detector for flaws, Eddy current test.		
	Radiographic Examination: X-ray and Gama ray generation and their practical application in radiography.		
	Ultrasonic test-Pulse echo method, through transmission method.		
	Total	32	80

marks only.

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

Sr.N	Topic	Cognitive Level			Total	
0.		Knowledge	Comprehensio	Application	Course	
		Level	n		Outcome	
1	Elasticity	08	04	04	MTF 302-1	16
2	Mechanical Testing	06	04	02	MTF 302-2	12
3	Hardness Tests	06	04	02	MTF 302-3	12
4	Impact	04	02	02	MTF 302-4	08
5	Fatigue	06	02	02	MTF 302-5	10
6	Creep Test	04	02	02	MTF 302-6	08
7	Non-Destructive	08	02	04	MTF 302-7	14
	Testing					
	Total	42	20	18		80

List of Practicals:

Sr. no	Laboratory experiment	Skills developed	Course Outcome
1	Tension Test- Study of Universal Testing Machine. Determination of U.T.S., yield strength, Ductility(%elongation), %	 Prepare specimen for tensile testing Operate U.T.M. Make pre test and post test measurements of the sample 	MTF 302-2

Sr. no	Laboratory experiment	Skills developed	Course Outcome
	reduction of area	4) Interpret the results of the stress-strain curve	
2	Hardness test- 1) Brinell hardness test 2) Vicker hardness test	 Prepare surface to conduct hardness test Operate Brinell and Vickers hardness testing machine- select and check mounting of the indentor, select load to be applied Measurement of indentation and deriving BHN/VPN from it 	MTF 302-3
3	Hardness test- 1) Rockwell hardness test 2) Poldi hardness test	 Prepare surface to conduct hardness test Operate Rockwell hardness testing machine- select and check mounting of the indentor, select load to be applied and scale according to the material Measurement of hardness number direct from scale Use Poldi hardness testing tools and measure hardness of sample 	MTF 302-3
4	Charpy and Izod Impact test	 Prepare sample for Charpy and Izod test- select design of notch Operate impact testing machine Measure the energy consumed in the impact and determine impact values 	MTF 302-4
5	Fatigue test	 Prepare sample for rotating beam fatigue testing machine Operate fatigue testing machine Take measurements and compare fatigue strength of different materials 	MTF 302-5

Sr. no	Laboratory experiment	Skills developed	Course Outcome
6	Non-destructive testing- 1) Magnetic particle test 2) Dye penetrant test 3) Ultrasonic testing	 Select suitable NDT method according to the requirement Conduct NDT as per instructions Analyze the results of tests. 	MTF 302-7

ASSESSMENT CRITERIA FOR TERM WORK

a) Continuous Assessment :

Every practical Sheet shall be assessed for **25** marks as per criteria given below

Sr.	Criteria	Marks allotted
No.		
1	Attendance	05
2	Preparedness for practical	05
3	Correctness and understanding	10
4	Line work and neatness	05
	Total	25

b) Progressive Skill Test :

One mid-term *Progressive Skill Test* of **50** marks shall be conducted as per criteria given below

Sr.	Criteria	Marks allotted
No.		
1	Correctness and understanding	20
2	Line work and neatness	10
3	Dimensioning and judgment without measurement	10

4	Proper use of instrument	10
	Total	50

Instructional Strategy:

Sr.No.	Торіс		Instructional Strategy
1.	Elasticity	i)	Lecture method
2.	Mechanical Testing	i)	Demonstration method
		ii)	Lecture method
3.	Hardness Test	i)	Demonstration
		ii)	Group Discussion method
4.	Impact Test	i)	Lecture method
		ii)	Demonstration method
5.	Fatigue Test	iii)	Lecture method
6.	Creep Test	iv)	Lecture method
7.	Non-Destructive Testing	i)	Video Cassettes
		ii)	Group Discussion

Text – Books:

Author	Title	Publisher
A.V.K.Suryanarayana	Testing of Metallic Materials	Prentice Hall of India, New Delhi
George E. Dieter	Mechanical Metallurgy	Mc Graw – Hill Book Company
Davis, Troxell And Wiskonell	Testing and Inspection of Engineering Materials	Mc Graw – Hill Book Company

Learning Resources: Transparency – O. H. P., Video Cassettes.

COURSE ID:

Course Name	: Metallurgical Analysis
Course Code	: MTF 303
Course Abbreviation	: EMAN

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits	
Theory	03	05	
Practical	02	05	

Evaluation Scheme:

Component	Progressive Assess	Term	Total		
	Theory	Practical	Theory	Term Work	
Details and Duration	Two tests of 20 marks (one hour each)	One mid- term Skill Test (2 hrs)	Term End Theory Exam (04 hours)	As per Proforma- III	
Marks	20	25	80	25	150

* Assessment as per Pro-forma - III

Rationale:

The metallurgical chemical analysis of metals and alloys determine their mechanical and physical properties. Application of Chemical analysis technique to develop new alloys and other metal, to solve daily problem of engineering metallurgy and manufacturing for determining chemical analysis, various techniques are used. While 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 analysis.

COMPETENCY:

Use various methods of chemical analysis to control quality of material in industry.

Cognitive: i) Understanding and applying various standard analysis techniques. ii) Observing iii)

Classifying iv) Interpreting

Psychomotor: Handling of instruments, apparatus and tools

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

COURSE OUTCOMES:

MTF 303-1 Use fundamentals of chemical analysis to conduct testing of materials in industry.

MTF 303-2 Use Gravimetric analysis for testing of materials in industry.

MTF 303-3 Use Volumetric analysis for testing of materials in industry.

MTF 303-4 Use various instrumental methods of chemical analysis for testing of materials.

MTF 303-5 Conduct chemical analysis of Ferro-alloys.

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

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

	Programme Outcomes POs and PSOs											
Competen cy and COs	PO 1 Basic knowle dge	PO 2 Discipl ine knowle dge	PO 3 Experim ents and practice	PO 4 Enginee ring Tools	PO 5 The engin eer and societ y	PO 6 Environ ment and sustaina bility	PO 7 Ethi cs	PO 8 Indivi dual and team work:	PO 9 Communi cation	PO 10 Life- long learni ng	PS O1	PS O2
COMPET												
ENCY : Use various methods of chemical analysis to control quality of material in industry.	2	3	3	2	2	2	_	2	1	2	1	1
MTF 303- 1	3	1	3	3	2	2	-	1	1	2	1	1
MTF 303- 2	3	2	3	2	2	2	-	1	1	1	1	1
MTF 303- 3	3	2	3	2	2	2	-	1	1	2	1	1
MTF 303- 4	3	3	2	3	2	1	-	2	1	2	1	1
CONTENT:

A) THEORY

Section I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
mater	rials in industry.	is to conduct	lesting of
1 Cours	Introduction Sampling methods of metals & alloys, Equipments used in chemical laboratory, Preparation of standard and dilute solution, Comparison between Qualitative & Quantitative analysis, accuracy, precision, error, Presentation of analysis, observation & computation. se Outcome MTF 303-2 Use Gravimetric analysis for testing of	12 of materials in	20 n industry.
2	Gravimetric analysis Chemical balances & their precision, solubility product, requirement of precipitated form, Condition of Precipitation and Masking, Filtration, Drying & Igniting of Precipitate, Weighing & requirement of weigh form, Determination of weight % of element from precipitate, Merits & Demerits of methods, Simple examples on Gravimetric analysis.	12	20

Section II

Cours	Course Outcome MTF 303-3 Use Volumetric analysis for testing of materials in industry.			
3	Volumetric Analysis	12	20	
	Analysis, Titration, Standardization of solutions, Use of			
	Indicators & their properties, requirement of volumetric			
	reaction, acid & alkalis, examples, Titration of oxidizing &			
	Reducing solutions, Advantages & Disadvantages of these			
	method.			
Carry		1 . 1 1	• • • •	

Course Outcome MTF 303-4 Use various instrumental methods of chemical analysis for testing of materials.

4	Instrumental Methods	08	15
	Carbon & sulphur by combustion method, Electro-		
	gravimetric analysis, Photo-electric		
	calorimeter/Spectrometer, Principle of spectroscopic		
	analysis, Introduction to Emission & atomic absorption		
	spectrometer. Advantage of these methods		
Cours	se Outcome MTF 303-5 Conduct chemical analysis of Ferro-a	ılloys.	
5	Analysis of Foundry Materials	04	05
5	Analysis of Foundry Materials Chemical Analysis of Ferro alloys such as Ferro silicon,	04	05
5	Analysis of Foundry Materials Chemical Analysis of Ferro alloys such as Ferro silicon, Ferromanganese. Determination of Mg in SG iron	04	05
5	Analysis of Foundry Materials Chemical Analysis of Ferro alloys such as Ferro silicon, Ferromanganese. Determination of Mg in SG iron Semester end exam question paper should be such that	04 total marks	05 of questions on
5	Analysis of Foundry Materials Chemical Analysis of Ferro alloys such as Ferro silicon, Ferromanganese. Determination of Mg in SG iron Semester end exam question paper should be such that each topic is one and half times the marks allotted above	04 total marks but the candid	05 of questions on dates are able to
5	Analysis of Foundry Materials Chemical Analysis of Ferro alloys such as Ferro silicon, Ferromanganese. Determination of Mg in SG iron Semester end exam question paper should be such that each topic is one and half times the marks allotted above attempt questions of the above allotted marks only.	04 total marks but the candid	05 of questions on dates are able to

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

Section		Distribution	of marks (Cogn	itive level-wise)	Course	Total
/ Topic no.	Name of topic	Remember	Understand	Application	Outcome	marks
I/1	Introduction	10	10		MTF 303- 1	20
I/2	Gravimetric Analysis	10	05	05	MTF 303- 2	20
II/1	Volumetric Analysis	05	05	10	MTF 303- 3	20
II/2	Instrumental Methods		05	10	MTF 303- 4	15
II/3	Analysis of Foundry Materials			05	MTF 303- 5	05
	Total	25	25	30		80

B) Practical shall consist of the following

Laboratory Experiments and related skills to be developed.

Sr. No.	Title of Experiment	Skills to be developed	Course Outcome
1	Preparation of standard solution	Sampling of Standard solution	MTF 303-1
2	Presentation of analysis	 To identify accuracy, precision and error Prepare and present report. 	MTF 303-1

3	Determination of C, Si, Mn, Cr, Mo.	Metallurgical analysis of steel, alloy steel by using gravimetric & volumetric analysis methods.	MTF 303-2
4	Analysis of brasses, bronzes	Electro-gravimetric and standard methods for analysis brass & bronzes	MTF 303-3
5	Analysis of white metal	Accurate analysis of white metals	MTF 303-4
6	Study of spectrometer	Chemical analysis of elements with proper handling of instrument.	MTF 303-5

Instructional Strategy:

Sr.No	Торіс	Instructional Strategy
1	Introduction	Lecture method
2	Gravimetric Analysis	Lecture method
		Question -Answer method
3	Volumetric Analysis	Lecture method
		Practical, Industrial visits
4	Instrumental method	Lecture method
		Demonstration, Industrial visit.
5	Method of Fire Assay.	Lecture method

Text Books:

Author	Title	Publisher
B.C.Agarwal & S.P. Jain	Text Book Of Metallurgical Analysis	Khanna Publisher, N. Delhi
Willgrd H. H.	Text Book Of Quantitative Analysis	East West Press, N.Delhi

Reference Books:

Author	Title	Publisher
V. Alexeyev	Quantitative Analysis	MIR Publisher, Moscow

Learning Resources: O.H.P / Transparencies, Charts

COURSE ID:

Course Name	: Extractive Metallurgy
Course Code	: MTF 304
Course Abbreviation	: ENFM

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	04
Practical/Tutorial	01	

Evaluation Scheme:

Component	Progressive Assess	ment	Term End		Total
	Theory	Practical	Theory	Term Work	
Details and Duration	Two tests of 20 marks (one hour each)	One mid- term Skill Test (2 hrs)	Term End Theory Exam (04 hours)	As per Proforma- III	
Marks	20	-	80	25	125

* Assessment as per Pro-forma - III

RATIONALE:

This course mainly deals with the various extraction processes of non-ferrous and rare earth metals from their ores. Knowledge of raw materials, methodology of extraction, furnaces and other necessary equipments required for extraction of non-ferrous metals in industry are crucial. Proper understanding of this course is very important in the field of application of various significant Non-Ferrous Metals & Alloys.

COMPETENCY:

Use various methods of chemical analysis to control quality of material in industry.

Cognitive: i) Understanding and applying various extractive metallurgical methods. ii) Observing iii) Classifying iv) Interpreting

Psychomotor: Handling of instruments, apparatus and tools

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

COURSE OUTCOMES

- MTF 304 -1: Identify the processes, unit processes used in extraction of metals from it's ores/ minerals
- MTF 304 -2: Identify iron ore and other raw materials and beneficiation processes of iron ores
- MTF 304 -3: Identify working of blast furnace parts, important chemical reactions and products produced
- MTF 304 -4: Use principles of thermodynamics in manufacturing of steel
- MTF 304 -5: Identify various steel making processes with their advantages and disadvantages
- MTF 304 -6: Use secondary steel making for the production of steel ingots
- MTF 304 -7: Use vacuum treatment for degassing of steel melt
- MTF 304 -8: Identify equipment and processes for continuous casting of steel ingots
- MTF 304 –9: Identify the processes in extraction of Aluminium from its ores

MTF 304 - 10: Identify the processes in extraction of copper from its ores and know about precious metals and their ores

CONTENT:

A. THEORY: SECTION-I

	Topics	Lecturers	Theory
Sr. no	Subtopics	(Hours)	Marks
MTF 304	-1: Identify the processes, unit processes used in extraction of metals fr	om it's ores/ m	inerals
	Principles of Extractive Metallurgy		
	Classification and sources of Metals, Minerals, Ores etc. Pyrometallurgy- Definition, principles involved, stages of Pyrometallurgy, advantages ,disadvantages	06	12
	Hydrometallurgy- Definition, stages of hydrometallurgy, principles of hydrometallurgy, advantages ,disadvantages		
	Electrometallurgy- Definition, principle of electrometallurgy, advantages ,disadvantages		
1	Comparison amongst Pyrometallurgy, Hydrometallurgy, electrometallurgy.		
	Principles of roasting and calcinations.		
	Roasting techniques: fluidized bed roasting, multiple hearth Roasting. Solvent extraction. Counter current decantation.		
MTF 304	-2: Identify iron ore and other raw materials and beneficiation processe	s of iron ores	
	Source of iron- types of iron ores/minerals. Properties of iron ores. Reducibility of iron ore.	04	04
	Raw materials & burden preparation for iron making		
2	Fluxes – Types, Properties, functions and applications Agglomeration – Methods (Pellets, Sinters, Briquetting, Noodulizing) need, advantages and principle involved. Palletisation- principle, techniques(disc and drum pelletiser),		
	Advantages		
	1		

G	Topics	Lecturers	Theory		
Sr. no	Subtopics	(Hours)	Marks		
MTF 304 -	MTF 304 –1: Identify the processes, unit processes used in extraction of metals from it's ores/ minerals				
MTF 304 –3: Identify working of blast furnace parts, important chemical reactions and products produced					
3	Blast Furnace Construction and Operation Constructional details and functions of Blast Furnace parts Blast Furnace Operation Working principle of blast furnace Operation of blast furnace. Chemical reactions at different zones in Blast Furnace, temperature profile in blast furnace. Efficiency of Blast Furnace Blast Furnace Products – composition of Pig Iron, slag and gas. Modern trends in Blast Furnace practice, Mini blast furnace.	04	08		

MTF 304 –4: Use principles of thermodynamics in manufacturing of steel				
4	 PRINCIPLES OF STEEL MAKING : Principles of steel making: a. Carbon reaction- decarburization b. Phosphorous reaction- dephosphorisation c. Sulphur reaction- desulphurization d. Manganese and silicon reactions. e. De-oxidation of steel Types of steel making processes- acid and basic steel making Present status of iron and steel industries in India. 	04	04	

STEEL MAKING PROCESSES: Bessemer process- principle, constructional details of Bessemer	MTF 304	-5: Identify various steel making processes with their advantages and c	lisadvantages		
converter, process details, outline, merits and demerits, characteristics of steel produced.Open-hearth process- principle, constructional details of open hearth furnace, process details, outline, merits and demerits , characteristics of steel produced.Electric steel making processes:06a. Electric arc furnace process: Electric are furnace 	5	 STEEL MAKING PROCESSES: Bessemer process- principle, constructional details of Bessemer converter, process details, outline, merits and demerits, characteristics of steel produced. Open-hearth process- principle, constructional details of open hearth furnace, process details, outline, merits and demerits , characteristics of steel produced. Electric steel making processes: a. Electric arc furnace process: Electric are furnace constructional details, charge materials, Process detail, outline, merits and demerits, characteristics of steel produced. b. Induction furnace: principles of heating process, charge materials, merits and demerits of process, characteristics of steel produced. Oxygen steel making - L.D. Converter: principle, constructional details of L.D. Converter, process details, outline, merits and demerits, characteristics of steel produced. 	06	12	

Section II

Sr. no.	Topics/ Subtopics	Lectures (Hours)	Theory evaluation Marks
MTF 304 -	-6: Use secondary steel making for the production of steel ingots		
6	SECONDARY STEEL MAKING PROCESS: Introduction and Merits of secondary steel making process. Synthetic slag refining,	06	08

		1	
	Decarburization techniques-AOD, VOD, CLU.		
	ESR and VAR process		
	Ladle furnace		
	Hybrid process		
MTF 304 -	-7: Use vacuum treatment for degassing of steel melt	I	
	VACCUM TREATMENT OF STEEL: Principles, Sieverts law		
	Degassing techniques.		
7	a. Ladle degassing	03	05
	b. Stream degassing		
	c. Recirculation degassing		
MTF 304 -	-8: Identify equipment and processes for continuous casting of steel in	gots	
8	CONTINUOUS CASTING OF STEEL: Principle of continuous casting. Construction of continuous casting machine and outline of processes. Types of continuous casting machines with their sketches and comparison. Merits, Demerits and modern development in continuous casting	03	05
	machines		
MTF 304 -	-9: Identify the processes in extraction of Aluminium from its ores		

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9	 Extraction of Aluminum Properties and uses of Aluminum. Ores/minerals of Aluminum, preparation of ore, current status of copper production in Aluminum. Feasibility of carbothermic reduction of Alumina. Requirements for aluminum extraction. Bayer's process- flow sheet, stages involved, factors affecting Bayer's process. Preparation of Cryolite- flow sheet and description with reactions involved. Manufacturing of carbon electrode. Hall Heraoult process (Aluminum cell) – Construction, working, composition and properties of bath, anode effect. 	06	10
MTF 304 - and their o	-10: Identify the processes in extraction of copper from its ores and kn res	ow about preci	ous metals
10	Extraction of Copper Properties and uses of copper. Ores/minerals of copper, preparation of ore Pyrometallurgy- production flow sheet (by conventional and newer route), stages of Pyrometallurgy Flash smelting of copper Continuous process of copper production. WORCRA process- features and merits of the process. Refining of Copper- fire and electrolytic refining Hydrometallurgy of copper- ferric chloride leaching of copper ore, advantages and disadvantages. Introduction to precious metals –Titanium, Gold, Silver Ores/minerals, current scenario	06	12
Semester e times the r only.	nd exam question paper should be such that total marks of questions of narks allotted above but the candidates are able to attempt questions	on each topic is of the above al	one and half lotted marks

Sr.no.	Topics	Instructional strategy
1	Principle of extraction	Lecture Methods
2	Extraction of copper	Lecture Method,
3	Extraction of aluminum	Lecture Methods,
5	Extraction of lead	Class room Teaching,
6	Extraction of zinc	Lecture method
7	Extraction of Uranium & Thorium	Lecture Methods, Practical

Instructional Strategy:

Text Books:

D .	KEFERENCE & TEAT BOOKS		
S.N.	Title	Author, Publisher, Edition	ISBN Number
		and Year Of publication	
1.	Mineral dressing	A.M. Gaudin	81-20300716-X
2	Extraction of Non-Ferrous	K. S. Ray, R. Sridhar &	81-7409-026-6
2.	Metals by	K.P. Abraham.	
3.	Extractive Metallurgy	R. S. Rosengwest	0-07-084453-4
4.	General Metallurgy	Kuznestsov	

D. REFERENCE & TEXT BOOKS

COURSE ID:

Course Name	: Foundry Technology I
Course Code	: MTF 305
Course Abbreviation	: EFTH-I

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Hours / week	Credits
Theory	03	05
practical hours	02	

Evaluation Scheme :

Mode of	ode of Progressive Assessment			Term End			
Evaluation	Theory	Practical	Theory	Term Work			
Details of Evaluation	Average of two tests of 20 marks each	One mid- term Skill Test (2 hrs)	Term End Theory Exam (04hours)	As per Proforma- III			
Marks	20	25	80	25*	150		

Rationale:

To enable the Metallurgy engineer to take up the supervisory role in various foundry practices such as ferrous and non-ferrous alloys, which are popularly, cast .He should also understand the other supporting activities for foundry.

COMPETENCY:

Knowledge of basic foundry practices.

Cognitive: Familiarize with the tooling of casting, moulding and melting process

Psychomotor: i) pattern Making ii)mould making iii)testing of green sand

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

- MTF 305-1 Understand the sections in foundry cores, molding, melting
- MTF 305-2 Use of Various Pattern, and pattern allowances
- MTF 305-3 prepare the mold and, identify types of core
- MTF 305-4 Use of other molding and casting process
- MTF 305-5 Use of miscellaneous molding processes.
- MTF 305-6 Draw sketch of Cupola furnace
- MTF 305-7 Use of various types fettling tools

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

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

		Programme Outcomes POs and PSOs											
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iments and practi ce	PO 4 Engin eering Tools	PO 5 The engine er and societ y	PO 6 Envir onme nt and sustai nabilit y	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metall urgist	PSO2 Safety and cleanli ness	PSO3 Recycl ing
Competency: Knowledge of basic foundry practices.	3	3	3	2	2	3	2	2	3	3	3	2	3
MTF 305-1	3	3	2	2	2	2	2	2	2	2	3	3	2
MTF 305-2	3	3	2	3	2	3	2	2	2	2	2	3	3
MTF 305-3	3	3	2	3	2	2	2	2	2	2	2	3	3
MTF 305-4	3	3	2	2	3	2	2	2	2	2	2	2	2
MTF 305-5	3	3	2	2	2	2	2	2	2	2	3	3	2
MTF 305-6	3	3	2	2	3	2	2	2	2	2	2	3	3

Course Content:

Section I

Sr.	Topics/	Lecturers	Theory Evaluation			
no	Subtopics	(Hours)	(Marks)			
Course	e Outcome MTF 305-1 Understand the sections in foundry cores, m	olding, melting				
	Introduction:	2	4			
1.	What is Foundry					
	Types of foundries					
	Different Section in Foundry					
	Foundry Layout					
	Importance of foundry technology					
	Casting v/s other manufacturing process					
	Advantages & limitations of foundry					
Course	e Outcome MTF 305-2- Use of Various Pattern, and pattern allowa	nces				

Sr.	Topics/	Lecturers	Theory Evaluation
no	Subtopics	(Hours)	(Marks)
	Pattern making:	08	12
2.	(i) Pattern material:		
	Function of pattern, Material for pattern and core boxes such as metal, wood, wax, Plaster, Plastic, thermocol etc.		
	(ii) Types of pattern:		
	Loose, match plate, one piece (solid) patter split, skeleton etc. Comparison of various patterns. Pattern plates for hand and machine molding, master pattern.		
	(iii) Pattern design and construction		
	Pattern allowances, pattern joints, parting line selection, loose pieces, location of pins on pattern, pattern-lifting devices, colour codes for pattern.		
Course	e Outcome MTF 305-3- prepare the mold and, identify types of core	2	
	Sand Molding Process:`	08	12
	(i)Function of molding sand, Classification of molding sand, ingredients		
	(ii)testing of Molding and core sand		
	(iii)Sand Reclamation		
	Core Making		
	Function of core, types of core(cold box, shellcore, No back core), core venting, dressing, baking.		
Course	e Outcome MTF 305-4- Use of other molding and casting process		L
4	Other sand molding processes:	06	12
	Green sand, Dry sand, CO2 sand, resin sand, loam sand,Shell molding,		
	(Principle/ ingredients, pattern and equipment's, casting size/alloy range, application, advantages, limitations)		

Sr.	Topics/	Lecturers	Theory Evaluation		
no	Subtopics	(Hours)	(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.					

Sr.	Topics	Teaching	Theory evaluation			
no.	Subtopics	(Hours)	Marks			
5.	Metal Mold Casting (i) Gravity Mold permanent mold Casting (ii) Die Casting-Hot chamber, Cold Chamber, Gravity, (low pressure, high pressure) (iii)Centrifugal casting (iv)Continuous casting (Principle/equipment's, casting size alloy range, application, and limitations.) 	10	12			
Cours	Course Outcome MTE 305-5 Use of miscellaneous molding processes					
6	Miscellaneous Molding Process: Such as plaster molding, ceramic molding, slush casting, pit and floor molding, Investment Casting	6	10			
Cours	e Outcome MTF 305-6 Draw sketch of Cupola furnace.					

7	MeltingFurnace	4	10		
	A] Cupola –				
	i) Principle ii) Working				
	iii) Fuel for cupola, calorific value for coke				
	iv) Melting procedure v) chemical composition control				
	vi) charge calculationsvii)Types of cupola				
	B] Proactive equipment use in foundry/Melting section				
8	Examples Of Selection Of Molding Processes:	4	04		
	With respect to quantity and weight of metal e.g. lathe bed manhole cover, piston ring, gear box housing, motor body, turbine housing etc.				
Cours	Se Outcome MTF 305-7 Use of various types fettling tools	I			
9	Finishing operations. Fettling, cleaning, finishing, Shotblasting, tumbling, sand blasting, Grinding chipping,cutting.	2	04		
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 paper

Sr no	Торіс	Distribution of Marks			Course Outcome	Total Marks
		Remember	Understand	Application	° acconte	
1	Introduction	04	-	-	MTF 305-1	04
2	Pattern Making	06	02	04	MTF 305-2	12

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3	Sand Molding	08	02	02	MTF 305-3	12
4	Other sand molding processes	08	02	02	-	12
5	Metal Mold Casting	06	03	03	MTF 305-4	12
6	Miscellaneous Molding Process	04	03	03	MTF 305-5	10
7	Melting Furnace	06	02	02	MTF 305-6	10
8	Examples Of Selection Of MoldingProcesses	02	-	02	-	4
9	Finishing operations	02	-	02	MTF 305-7	4
	Total	46	14	20		80

Laboratory experiences and related skills developed.

Sr. no	Laboratory experience	Skills developed
1	Study of various patterns, match plates etc.	To understand the various types of patterns such as solid pattern, split pattern etc.
2	Determination of various sand properties	1) To understand the various methods of sand testing such as Green Compression strength,compactbility,moisturetrest,permea bility etc.
3	Green sand molding	 To understand the preparation of green sand To understand the various additives in the green sand moulding. To understand the making of mould by green sand
4	Shell molding	1) To understand the sequence of making a shell by dump box method.
6	Casting aluminum in gravity die casting, in centrifugal die casting	1) To know the construction of die in die- casting

Sr. no	Laboratory experience	Skills developed
		2) To understand the making of casting by using the dies.
7	Study of cupola furnace Visit to various foundries to see cupola	 3) To understand the construction of cupola furnace & its various parts 4) To understand the operation of cupola furnace.

Text-Books:

Author	Title	Publisher
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

Instructional Strategy:

Sr. No	Topics	Instructional Strategy
1	Introduction	Lecture Method
2	Pattern Making	Practical, Lecture Method
3	Sand Molding	Practical, lecture method industrial visit.
4.	Other sand molding processes	Practical, lecture method industrial visit.
5	Metal Mould Casting	Practical lecture methods, industrial visit.
6	Miscellaneous Molding Process	Lecture method industrial visit

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7	Melting Furnace	Practical, lecture methods, industrial visit
8	Examples Of Selection Of MouldingProcesses	Discussion assignments
9	Finishing operations.	lecture methods, industrial visit.

COURSE ID:

Course Name : Electrical Engineering and Electronics

Course Code : MTF 306

Course Abbreviation : FEEE

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme :

	Progressive Assess	ment	Term	Total	
Component	Theory	Practical	Theory	Term Work	
Details and Duration	Two tests of 20 marks (one hour each)	One mid- term Skill Test (2 hrs)	Term End Theory Exam (04 hours)	As per Proforma- III	
Marks	20	25	80	25*	150

* Assessment as per Pro-forma - III

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.

COURSE OUTCOMES:

- MTF 306-1 To understand the basic and fundamental principles of various electrical.
- MTF 306-2 To understand operation & measurements of instrument.
- MTF 306-3 To understand operation & principles of electric heating.
- MTF 306-4 To understand operation & principles of electric welding.
- MTF 306- 5To understand safety management system.
- MTF 306-6 To understand basic electronice devices
- MTF 306-7 To understand modern electronics based Metallurgical equipments.
- MTF 306-8 To understand modern transducers equipments
- MTF306-9 To understand numbering system.

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

	Programme Outcomes POs and PSOs												
Competency and COs	PO 1 Basic knowl edge	PO 2 Disci pline kno wled ge	PO 3 Experim ents and practice	PO 4 Enginee ring Tools	PO 5 The engineer and society	PO 6 Environ ment and sustaina bility	PO 7 Ethics	PO 8 Individu al and team work:	PO 9 Comm unicatio n	PO 10 Life- long learning	PSO1 Role of Metallur gist	PSO2 Safety and cleanline ss	PSO3 Recyclin g
<i>MTF306-1: To</i> <i>understand</i> the basic and fundamental principles of various electrical.	2	2	2	3	1	2	2	2	2	3	2	1	1
MTF 306-2 To understand operation & measurements of instrument	2	2	1	1	-	1	1	1	1	1	1	1	1
<i>MTF306-3</i> To understand operation & principles of electric heating	1	2	3	2	-	1	2	2	2	3	1	1	
<i>MTF306-4</i> To understand operation & principles of electric welding.	1	1	2	3	1	1	2	2	1	2	1		
MTF 306-5 To understand safety management system	2	2	3	3	2	2	2	2	2	3	1		
<i>MTF306-6</i> To understand basic electronice devices	2	2	3	3	2	2	2	2	2	3	1		
MTF 306-7To understand modern electronics	2	2	3	3	2	1	2	3	3	3	1		

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

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	1				Drogr	ommo Ou	toomog D(and PS	Oc.				
		r rogramme Outcomes r Os and r 505											
Competency and COs	PO 1 Basic knowl edge	PO 2 Disci pline kno wled ge	PO 3 Experim ents and practice	PO 4 Enginee ring Tools	PO 5 The engineer and society	PO 6 Environ ment and sustaina bility	PO 7 Ethics	PO 8 Individu al and team work:	PO 9 Comm unicatio n	PO 10 Life- long learning	PSO1 Role of Metallur gist	PSO2 Safety and cleanline ss	PSO3 Recyclin g
equipments													
<i>MTF306-8</i> To understand modern transducers equipments	1	2	2	2	1	2	2	2	2	2	1		
<i>MTF306-9</i> To understand numbering system	2	2	3	2	2	2	1	2	2	2	1		

Theory:

SECTION I :-

Sr. no	Topics Subtopics	Teachin g (Hours)	Theory Marks			
Course	e Outcome MTF306-1 :To understand the basic and fundamental princip	les of variou	s electrical.			
1	Fundamentals A.C. and D.C. currents ,electrical potentials,resistance,ohm's law, electric circuits ,series and parallel resistance ,circuit & voltage distribution ,work,power,energy,and their S.I.units ,Effects of electric current –Magnetic ,chemical & heating effect,Flemigs rules, Right hands grip rule ,Faraday's laws of electromagnetic induction (Numerical equations on resistance circuits and work, power and energy.)	04	08			
Course	e Outcome MTF306-2 To understand operation & measurements of instr	rument				
2	Measuring Instrument Salient constitutional features and operating principles of PMMC,MI and dynamometer type instruments ,application and method of connection of ammeter ,voltmeter and wattmeter in a circuit, induction type single phase energy meter(Descriptive treatment only)	06	10			
Course	Course Outcome MTF306-3 To understand operation & principles of electric heating					
3	Electrical Heating Principles, Types and advantages of heating, Resistance heating, Resistance ovens, Arc furnaces, induction heating, Principles of working of eddy current heating and dielectric heating. Applications of electric heating, power factor improvement and its economics. (Descriptive treatment only)	08	14			

Course	Course Outcome MTF306-4 To understand operation & principles of electric welding.							
4	Electric Welding Princple, Advantages, Types of welding, resistance welding and Arc welding applications. (Descriptive treatment only)	03	04					
Course	Course Outcome MTF306-5 To understand safety management system.							
5	Electrical safety: Different Types of wires, standard gauges, Defination and necessity of earthing, Types, Safety and first aid measures. Study of cabling systems for heavy electric equipments. (Descriptive treatment only)	03	04					

THEORY :

SECTION – II

Sr. no	Topics Subtopics	Teachin g (Hours)	Theory Marks
Course	e Outcome MTF306-6 To understand basic electronice devices		
6	Semiconductor Theory and devices Conductors, semiconductors, Silicon crystal, Intrinsic semiconductor, extrinsic semiconductor and its types. Semiconductor PN junction diode, Bipolar junction transistor(BJT),Unipolar junction transmitter(UJT) Field effect transmitter(FET),MOSFET,Photo devices,	07	08

Course	Course Outcome MTF306-7 To understand modern electronics based Metallurgical equipments.					
7	Electronic Measuring instruments Measuring Instruments- Introduction, Advantages of Electronic Instruments, Types-Analogue & Digital, Digital Measuring Instruments, Digital voltmeter /Ammeter, Digital Multimeter,Digitral frequency meter	07	12			
Course	<i>c Outcome MTF306-8</i> To understand modern transducers equipments.					
	Transducers					
8	Introduction, Types of transducers, Selecting transducers	07	12			
0	Electrical transducers & its types, temperature transducers and pressure transducers.					
Course Outcome MTF306-9 To understand numbering system.						
	Digital electronics					
9	Number System-binary, Hexadecimal, conversion, arithmetic.	04	08			
	Logic gates-Symbols, truth tables					

Sr.No.	Торіс	Co	Total		
		Knowledge	Compre	Appln	
		Level			
1	Fundamentals	04	04		08
2	Measuring Instrument	06		04	10
3	Electrical Heating	06	04	04	14
4	Electric Welding	04			04
5	Electrical safety:	04			04
6	Semiconductor Theory and devices	04		0	08
7	Electronic Measuring instruments	08		04	12
8	Transducers	08		04	12
9	Digital electronics	06		02	08

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

ASSESSMENT CRITERIA FOR TERM WORK

a) Continuous Assessment of

Every practical Sheet shall be assessed for 25 marks as per criteria given below

Sr. No.	Criteria	Marks allotted
1	Attendance	05
2	Preparedness for practical	05
3	Correctness and understanding	10

4	Line work and neatness	05
	Total	25

b) Progressive Skill Test :

One mid-term *Progressive Skill Test* of **50** marks shall be conducted as per criteria given below

Sr.	Criteria	Marks allotted
N0.		
1	Correctness and understanding	20
2	Line work and neatness	10
3	Dimensioning and judgment without measurement	10
4	Proper use of instrument	10
	Total	50

Instructional Strategy:

Sr.No.	Торіс		Instructional Strategy
1.	Fundamentals	i)	Lecture method
2.	Measuring Instrument	iii) iv)	Demonstration method Lecture method
3.	Electrical Heating	iii) iv)	Demonstration Group Discussion method
4.	Electric Welding	v) vi)	Lecture method Demonstration method
5.	Electrical safety:	vii)	Lecture method
6.	Semiconductor Theory and devices	viii)	Lecture method
7.	Electronic Measuring instruments	iii) iv)	Video Cassettes Group Discussion

8.	Transducers	v)	Lecture method
9.	Digital electronics	vi)	Lecture method

Learning Resources: Transparency – O. H. P., Video Cassettes, models.

References

- 1) Basic Electrical Engg.(V.N.Mittal)
- 2) Principles of Electrical Engi & Electronics (V.K.Mehta)

COURSE ID:

Course Name	: Physical Metallurgy I
Course Code	: MTF307
Course Abbreviation	: FPMT-I

TEACHING AND EVALUATION SCHEHE:

Pre-requisites: < *nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical hours	02	

Evaluation Scheme:

Mode of	Progress	ive Assessment	Term End Ex		
Evaluation	Theory	Theory Practical		Oral	Total
Details of Evaluation	Average of two tests of 20 marks each	 i. 25marks for each practical ii. One PST of 25 marks 	Term End Theory Exam (3 hours)	As per proforma-VI	
Marks	20	25	80	25	150

RATIONALE:

This subject deals with the solidification of metals and alloys, and various types of equilibrium diagrams and their applications. It covers metallographic examination of metals and alloys such as macroscopic examination and quantitative Metallography. The subject includes study of iron-iron carbide equilibrium diagrams, Equilibrium diagrams of various non ferrous alloys.

COMPETENCY:

Use fundamentals in Metallurgy to understand properties of metals and alloys with reference to temperature and other variables

Cognitive: Understanding & applying principles of physical metallurgy in engineering field.

Psychomotor: i) Drawing and plotting equilibrium diagrams ii) Use of Metallurgical Microscope iii) Preparation of specimen for microstructure analysis

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

- MTF307-1 Use basic principles, terminologies, concepts, rules and reactions considered in Metallurgical studies in usage of metals and alloys and identify nature, properties and transformations of phases in common alloy systems.
- MTF307 -2 Draw the equilibrium diagrams of basic alloys systems on the basis of cooling curves and solubility.
- MTF307 -3 Draw Iron Carbon equilibrium diagram and identify critical points, reactions and phases in the diagram.

MTF307-4 Use basic Metallographic practices to study microstructures of ferrous and non ferrous alloys.

MTF307-5 Identify the applications of cast iron family with reference to its types, properties and microstructures.

MTF307-6 Identify common non ferrous alloys, their chemical composition, properties and applications.

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

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

	Programme Outcomes POs and PSOs												
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 The engin eer and societ y	PO 6 Env. and sustai nabili ty	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safety and cleanl iness	PSO3 Recyc ling
Competency Use the fundamentals of Metallurgy to understand properties in metals and alloys with reference to temp. and other variables.	3	3	2	3	1	2	1	2	3	3	3	1	2
MTF307-1	3	3	-	3	1	3	1	1	2	2	3	3	-
MTF307-2	3	3	2	3	-	3	1	2	2	2	2	3	3
MTF307-3	2	3	3	1	1	-	2	1	1	1	2	3	3
MTF307-4	3	3	2	2	3	-	2	1	1	2	2	3	3

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	PO 1	Programme Outcomes POs and PSOs											
Competency and Cos	Basic knowl edge	PO 2 Discip line knowl edge	Exper iment s and practi ce	FO 4 Engin eering Tools	The engin eer and societ y	Env. and sustai nabili ty	Ethics	Indivi dual and team work:	Com munic ation	Life- long learni ng	Role of Metal lurgis t	Safety and cleanl iness	Recyc ling
MTF307-5	3	2	1	3	-	2	1	1	2	2	3	3	2
MTF307-6	3	3	2	1	3	-	2	1	1	2	2	3	3

Section I

Sr.	Topics	Teaching	Theory
no	Subtopics	(Hours)	Marks
MTF	307-1 Use terminologies, basic concepts, rules and reactions used in M	etallurgical stu	dies and
ident	tify nature, properties and transformations of phases in common alloy sy	vstems.	
1.	Crystallography: Bravais lattice, Average no. atoms per unit cell, co-ordination number, atomic packing factor (APF) of S.C., B.C.C., F.C.C. and C.P.H. crystal structures, Miller indices for planes and directions, Imperfections in crystals-Point, line, surface defects Polymorphism	04	06
2	Solidification Of Metals : (1)Transformation of liquid metals in to solid metals, cooling curves,	08	12

Sr.	Topics	Teaching	Theory
no	Subtopics	(Hours)	Marks
MTF307-1 Use terminologies, basic concepts, rules and reactions used in Metallurgical studies and identify nature, properties and transformations of phases in common alloy systems.			
1.	Crystallography: Bravais lattice, Average no. atoms per unit cell, co-ordination number, atomic packing factor (APF) of S.C., B.C.C., F.C.C. and C.P.H. crystal structures, Miller indices for planes and directions, Imperfections in crystals-Point, line, surface defects Polymorphism	04	06
	 nucleation dendrite formation, nucleation & growth mechanism. (2)Grains and grain boundaries, cooling curves for pure metals and alloys (3)Phase Equilibrium, Gibb's phase rule and applications, Solid solution, Hume Rothery rules with examples. (4)Types of solid solution substitutional, intermetallic compounds 		
MTF307-2 Draw equilibrium diagrams of basic alloys systems on the basis of cooling curves and solubility.			
3	Equilibrium Diagram: Cooling curves and construction of a binary equilibrium diagram, reactions in binary system. Monoeutectic, eutectic partial solubility. Eutectoid and peritectoid reactions. Lever rule and its applications. Identification of microstructural changes with respect to equilibrium diagram.	04	08
<i>MTF307 –3 Draw Iron-Carbon equilibrium diagram and identify critical points, reactions and phases in the diagram.</i>			
4	Iron Carbon Diagram: Allotropic transformation of pure iron phases, Cooling of steels, Peritectic reaction, Eutectic reaction, Eutectoid reaction, Relationship between microstructure and properties of steel, Effect of carbon on properties, microstructure	04	08
MTF307-4 Use basic Metallographic practices to study microstructures of ferrous and non ferrous			
Sr.	Topics	Teaching	Theory
--	---	-----------------------------	----------
no	Subtopics	(Hours)	Marks
MTF ident	307-1 Use terminologies, basic concepts, rules and reactions used in M tify nature, properties and transformations of phases in common alloy sy	etallurgical stu vstems.	dies and
Crystallography:Bravais lattice, Average no. atoms per unit cell, co-ordination number, atomic packing factor (APF) of S.C., B.C.C., F.C.C. and C.P.H. crystal structures, Miller indices for planes and directions, Imperfections in crystals-Point, line, surface defects Polymorphism		04	06
alloy	25		
5	Introduction to Metallography: Preparation techniques of specimen, Mounting- thermal and cold setting resins, Methods of polishing - mechanical and electrolytic polishing, Etching techniques and etching reagents, Metallurgical microscope –Principle, Construction and working.	04	06

Section II

Sr.	Topics	Teaching	Theory
no.	Subtopics	(Hours)	Marks
MTF30	07-5 Identify the applications of cast iron family with reference to its types	, properties	and
microsi	tructures.		
6	Cast Iron:		
	Types of CI, composition, microstructure, properties and applications	10	14
	Graphitization in cast iron, morphology of graphite Fe-C-Si diagram,		
	carbon equivalent, shapes ,types of graphite A,B,C,D, & E types of		
	distribution ,size of graphite, ASTM matrix structure of cast iron.		

MTE3	 Relation with microstructure and properties, phosphide eutectic, properties of CI, tensile strength, machinability, damping capacity, ductility, impact strength and hardness etc. IS specification for GCI & S.G iron. 08-6 Identify common types of non ferrous alloys, their chemical composition of the strength of the strengt	tion, proper	ties and
applic	rations		
7	Metallurgy of Cu- Alloys:		
	(1)Brasses: Cu- Zn equilibrium diagram, order-disorder transformation, dezincification, hot working of brasses, orange peel, season cracking.	05	09
	(2) Bronzes: Cu- Sn Alloys, Equilibrium diagram, Composition, properties & applications of commonly used bronzes, Gun metal, Phosphor Bronzes, aluminum bronzes, Beryllium bronze.		
8	Aluminum Alloys:		
	Al-Si Alloy equilibrium diagram, composition, properties and application of Al alloy, LM series, Modification of Al alloy	05	09
	Al- Cu alloy equilibrium diagram, Duralumin: composition, heat treatment, properties and applications		
9	Bearing metals:		
	Classification of bearing alloys, requirement of good bearing metals, Sn- Sb alloys, composition, microstructure, mechanical properties and application of lead based and tin based babbits, effect of Cu addition.	04	08
Semes half ti marks	ster end exam question paper should be such that total marks of questions mes the marks allotted above but the candidates are able to attempt quest only.	on each top ions of the a	ic is one and bove allotted

Sr	Торіс	Distribution of Marks			Course	Total
no		Remember	Understand	Application	Outcome	Marks
1	Crystallography	02	04	-	MTF307-1	06
2	Solidification of Metals	04	04	04	MTF307-1	12
3	Equilibrium Diagrams	02	04	02	MTF307-2	08
6	Iron Carbon Diagram	02	02	04	MTF307-3	08
4	Introduction to Metallography	-	02	04	MTF307-4	06
7	Cast Iron	06	04	04	MTF307-5	14
8	Metallurgy of Cu alloys	04	02	03	MTF307-6	09
9	Aluminum alloys	04	02	03	MTF307-6	09
10	Bearing Metals	02	03	03	MTF307-6	08
	Total	53	13	14		80

Specification Table for setting question paper for semester end theory paper

Laboratory experiments and related skills developed.

Sr. no	Laboratory experiment	Skills developed	Course Outcome
1	Prepare Metallurgical specimen for microscopic analysis.	 Preparation of specimen. Mounting of specimen. Etching techniques. 	MTF307-1
2	Study working principle of Metallurgical microscope.	 Use metallurgical microscope for analysis of microstructure. Selecting and adjusting magnification. 	MTF307-4

Sr. no	Laboratory experiment	Skills developed	Course Outcome
3	Microstructures of plain carbon steels: 0.2%C, 0.4%C, 0.6%C, 0.8%C, 1.0%C	 Identify and estimate various phases such as ferrite, pearlite, cementite in the structure. Correlate the microstructure & chemical composition of the steels. 	MTF307-3
4	Microstructures of cast irons	 Identify the various microstructures of the cast irons. Identify shape, size and distribution of the graphite flakes in grey cast iron. Use ASTM charts for various measurements in the microstructure. Identify nodule shape, size, count and nodularity in S. G. iron of the S.G.Iron. Identify various types of nodules in the structure of S. G.Iron. 	MTF307-5
5	Microstructures of copper, aluminum alloys and bearing metals.	Identify the various phase present in the nonferrous alloys such as Cu and Al alloys.	MTF307-6

Instructional Strategy:

Sr. No	Торіс	Instructional Strategy
110.		
1	Crystallography	Class room teaching and demonstration
2	Solidification of Metals	Class room teaching, demonstration
3	Equilibrium Diagrams	Class room teaching
4	Iron Carbon Diagram	Class room teaching
5	Introduction to Metallography	Class room teaching and practicals

Sr.	Торіс	Instructional Strategy
No.		
1	Crystallography	Class room teaching and demonstration
6	Cast Iron	Class room teaching and practicals
7	Metallurgy of Cu Alloys	Class room teaching and practicals
8	Aluminum Alloys	Class room teaching and practicals
9	Bearing Metals & Alloys	Class room teaching and practicals

Textbooks:

Author	Title	Publisher
Guy	Elements of physical	Addison-Wesley Publishing
	metallurgy	Company, INC, London
Clark and Verney	Physical metallurgy for engineers	CBS publishers and distributors
Avner	Introduction to Physical Metallurgy	Tata McGraw Hill Publishing Company Ltd, New Delhi.

Reference Books:

Author	Title	Publisher
George L.Khel	Metallurgical laboratory practice	Eurasia Publishing House (Pvt) Ltd, New Delhi
Robert E. Reed - Hill	Physical Metallurgy principles	Affiliated East-West Press Pvt. Ltd, New Delhi.

Learning Resources: Models, charts, structures, slides and photographs

COURSE ID:

Course Name	: Mechanical Engineering
Course Code	: MTF 308
Course Abbreviation	: EMEC

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme :

	Progressive Assess	ment	Term	End	Total
Component	Theory	Practical	Theory	Term Work	
Details and Duration	Two tests of 20 marks (one hour each)	One mid- term Skill Test (2 hrs)	Term End Theory Exam (04 hours)	As per Proforma- III	
Marks	20	25	80	25*	150

* Assessment as per Pro-forma - III

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.

OBJECTIVES:

The students will be able:

- 1. To understand working principles of heat transfer.
- 2. To understand the working principal of compressor and pumps etc.
- 3. To use the instruments for measuring pressure, velocity, flow.
- 4. To know the basic knowledge about the I.C. Engines.
- 5. To know the basics of thermodynamics and gas processes.
- 6. To understand the properties of fluids. To get introduction to Industrial Hydraulics Conduct all the tests and calculate the values of different properties.

COURSE ID:

Course Code	Course Name	Course Abbreviation
MTF 308	Mechanical Engineering	EMEC

COMPETENCY: Familiarize with the science of Mechanical Engineering to understand the importance of Machine Drawing in developing the Factors and Mechanics with reference to Principle of Mechanical and other variables

Cognitive: Understanding & applying principles of Mechanical engineering field

Psychomotor: Explaining and Plotting Machine Components and Views ii) Preparation of Design Principle of Fluid mechanics, IC Engine, RAC and Thermodynamics

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

- MTF 308-1- Evaluate different Machine Components and techniques of improving Mechanics
- MTF 308-2- Study of Engineering Drawing and Graphics.
- MTF 308-3- Prepare process of Automobile Fields or sector in IC Engines.
- MTF 308-4- Activities carried in Heat Transfer of Conduction, Convection and Radiation.
- MTF 308-5- Study of Fluid Mechanics and Properties
- MTF 308-6- Decide Power transmission Devices.
- MTF 308-7- Application of Pumps and Compressor.
- MTF 308-8- Study of Hydraulics and Pneumatics Devices.

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

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

				Prog	ramme	Outco	mes P(Os and	PSOs				
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 The engin eer and societ y	PO 6 Envir onme nt and sustai nabili ty	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safety and cleanl iness	PSO3 Recycl ing
MTF 308-1	2	1	2	3	1	-	3	2	2	2	2	2	3
MTF 308-2	3	2	1	2	1	-	2	1	1	2	3	2	-
MTF 308-3	3	3	2	3	1	-	1	-	1	3	2	3	2
MTF 308-4	2	3	3	2	1	-	1	-	-	3	2	3	3
MTF 308-5	2	2	3	3	2	-	1	-	2	3	2	2	2
MTF 308-6	3	2	3	3	-	-	2	2	3	3	3	2	2

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				Prog	ramme	Outco	mes PC)s and	PSOs				
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 The engin eer and societ y	PO 6 Envir onme nt and sustai nabili ty	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safety and cleanl iness	PSO3 Recycl ing
MTF 308-7	1	2	3	3	1	1	2	3	3	3	2	1	2
MTF 308-8	3	1	2	2	-	-	3	2	3	3	2	2	3

CONTENT:

SECTION-I

Sr.	Topics	Teaching	Monka				
No.	Subtopics	(Hours)	Marks				
Course improv	Course Outcome-MTF 308-1-Evaluate different Machine Components and techniques of improving Mechanics						
	Advance Sectional Orthographic view						
1.	Crankshaft, Engine body, camshaft, flanged coupling, pump body.	06	10				
Course	Course Outcome-MTF 308-2- Study of Engineering Drawing and Graphics.						
	Types Of Sections						
2	Conventional, revolved, removed, partial, offset, flywheel, pulley, gear.	02	04				
Course	Outcome-MTF 308-3- Prepare process of Automobile Fields or	sector in IC E	ngines.				
	I.C. Engines						
3	Classification, Different parts, Materials used,	06	12				
	Working principle of two stroke, four stroke, Petrol, Diesel engines and difference between them.						
Course Outcome-MTF 308-4- Activities carried in Heat Transfer of Conduction, Convection and Radiation.							

Sr.	Topics	Teaching	Manha
No.	Subtopics	(Hours)	WIAFKS
	Heat Transfer		
4	Modes of heat transfer,	10	14
	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)		

SECTION-II

Sr.	Topics	Teaching	Montra
No.	Subtopics	(Hours)	IVIALKS
Course	e Outcome-MTF 308-5- Study of Fluid Mechanics and Properties		
5	Properties of Fluids		
	Fluid & its Properties- Mass density, Sp. wt, Sp. Volume, Sp. Gravity, Viscosity, Vapor pressure, Compressibility and Surface tension.	04	10
	Measurement of Pressure, Discharge and Velocity.		
	(Simple Numerical)		
Course	e Outcome-MTF 308-6- Decide Power transmission Devices.		
6	Power Transmission Device	04	10
	Rope drive, Pulley Belt Transmission & types, Chain drive, Gear drive, Advantages, Disadvantages & applications.		
Course	e Outcome-MTF 308-7- Application of Pumps and Compressor.		
7	Pumps and Compressors	06	08
	Classification, Construction and Working, applications.		
Course	e Outcome-MTF 308-8- Study of Hydraulics and Pneumatics Devic	ces.	

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
		48	80

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-

Sr. No	Торіс	Cog		Tota		
•		Knowle dge Level	Com pre- hensi on	Applic a- Tion	Course Outcome	1
1	Advanced Sectional Orthographic View	02	04	04	MTF-308- 1	10
2	Types Of Section	02		02	MTF-308- 1	04
3	I.C. Engine	02	04	06	MTF-308- 2	12
4	Heat Transfer	06	04	04	MTF-308-	14

					3		
5	Properties of Fluids	02	04	04	MTF-308- 4	10	
6	Hydrokinetics	04	04	02	MTF-308- 4	10	
7	Pumps and Compressors	04		04	MTF-308- 4	08	Laboi atory
8	Introduction to Industrial Hydraulics and Pneumatics	02	04	06	MTF-308- 4	12	experiences and

related skills developed.

Sr. No.	Laboratory experience	Skills developed	Course Outcome
1	Sectional Orthographic Views – One Sheet	Understanding of Views	MTF-308-1
2	Drawing of I.C.Engines components – One Sheet	Understanding of Drawing and Sections of various parts.	MTF-308-2
3	Blue print of the above sheet.	Understanding of Blue print reading.	MTF-308-2
4	Demonstration of I.C. Engine.	Starting and running of engine.	MTF-308-3
5	Demonstration of Compressor.	Starting and running of compressor.	MTF-308-3
6	Demonstration of Pumps – Centrifugal & Reciprocating	Starting and running of various pumps.	MTF-308-3
7	Calculation of heat transfer for a furnace.	Measurement of heat.	MTF-308-4
8	Experiment to measure flow (rotameter),	Measurement of Flow.	MTF-308-4
	Pressure (Bourdon gauge), Velocity (Pitot Tube)		
9	Experiments on Hydraulic bench.	Industrial Hydraulics & their control.	MTF-308-4
10	Experiments on Pneumatic bench.	Industrial Pneumatics & their control.	MTF-308-4

Sr. No	Criteria	Marks allotted
1	Attendance at regular practical	2.5
2	Preparedness for practical	5
3	Correct figures / diagrams	5
4	Observation tables	5
5	Result table / calculations / graphs	5
6	Safety / use of proper tools	2.5
	Total	25

Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

Teaching and Learning resources, including references:

Chalk-board.

Demonstrative kits.

Demonstrative charts.

Industrial Visits

Experimental work benches.

Videocassette, Transparencies, Models.

Reference Books:

Author	Title	Publisher
Khurmi	Hydraulic Machinery	S.Chand Co Ltd., New Delhi
Patel Karmachandani	Heat Engine	Ahcarya Publication
Jagadish Lal	Hydraulic Machinery	Metropolitan Publishers
S.P.Sukhatme	Heat Transfer	Tata Mc Graw Hill
Pipenger	Industrial Hydraulics and Pneumatics	Tata Mc Graw Hill

COURSE ID:

Course Name	: Furnace, Refractories and Pyrometry
Course Code	: MTF 309
Course Abbreviation	: FFRP

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical hours	02	05

Evaluation Scheme:

	Progressive Assessment		Term End Examination			
Mode of Evaluation	Theory	Term Work	Theory Examination	Oral	Total	
Details of Evaluation	Average of two tests of 20 marks each	As per proforma- III	Term End Theory Exam (3 hours)			
Marks	20	25	80		125	

Rationale:

To enable the Metallurgy engineer to take up the supervisory role in melting section of foundry such as ferrous and non-ferrous alloys, which are popularly, cast .He should also understand the other supporting activities for melting of metals.

Competency: Knowledge of basics of furnace, refractories and Pyrometry.

Cognitive: Familiarize with the construction and working of metallurgical furnaces. **Psychomotor:** Operating furnace.

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

MTF309-1 Use of refractories in various furnaces

MTF309-2 Proper use of melting furnace with melting principle

MTF309-3 Identify various types of furnaces MTF309-4 Selection of furnace for melting ferrous metals MTF309-5 Use of proper furnace for melting non ferrous metals MTF309-6 Use of proper pyrometer for temperature measurement

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

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

				Progr	amme	Outco	mes P	Os and	PSOs				
Competency and Cos	PO 1 Basic knowl edge	PO 2 Disci pline knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eerin g Tools	PO 5 The engin eer and societ y	PO 6 Envir onme nt and sustai nabili ty	PO 7 Ethic s	PO 8 Indivi dual and team work:	PO 9 Com muni cation	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safet y and cleanl iness	PSO3 Recyc ling
Competency: Knowledge of furnace, refractories and Pyrometry	3	2	2	3	2	2	2	3	2	2	3	3	3
MTF309-1	3	2	3	2	2	1	2	2	1	2	3	1	2
MTF309-2	3	3	2	3	2	2	1	1	1	3	2	3	1
MTF309-3	3	3	2	2	2	1	1	2	-	3	2	2	3
MTF309-4	3	2	3	3	2	-	1	2	2	3	2	2	1
MTF309-5	3	2	3	3	-	1	1	1	2	3	3	2	2
MTF309-6	3	2	3	3	-	-	1	2	2	3	3	2	2

Course Contents:

Sr. no	Topics Subtopics	Teachin g (Hours)	Theory Marks			
	Section I					
MTF3	09-1 Use of refractories in various furnaces					
1	Refractories for furnace / ladle liningA] Definition, classification, Types & Properties of refractoriesB] Special refractoriesC] Selection of refractoriesD] Testing of refractoriesE] Refractory failuresF] Applications of Refractories	07	12			
MTF3	09-2 Proper use of melting furnace with melting principle					
2	Introduction To Furnaces A] Classification B] Furnace auxiliaries- burners, fan, control valve, damper C] Introduction of different furnaces- Pit, Rotary, Cupola, Indirect arc, Direct arc furnace (Energy Consumption, advantages disadvantages, application of each furnace)	10	16			
MTF3	09-3 Identity various types of furnaces					
3	Miscellaneous furnaces A] Reverberatory furnace B] Open hearth furnace C] Electric resistance furnace- Muffle furnace (Construction, working and applications)	07	12			
	Section II					
MTF3	209-4 Selection of furnace for melting ferrous metals					
4	Electric Furnaces (Steel melting) A] Arc furnaces i) Direct arc furnaces ii) Indirect arc furnaces (construction, working & application, refractory material) B] Induction Furnaces i) Mains frequency ii) Medium frequency (construction, working & application, refractory material)	10	16			

MTF3	809-5 Use of proper furnace for melting nonferrous metals		
5	Melting of Nonferrous Materials A] Crucible furnace i) Lift out type (coke fired Furnace) ii) Tilting type (Oil and Gas fired furnaces) (Working & application)	06	08
MTF3	09-6 Use of proper pyrometer for temperature measurement		
6	PyrometryIntroductionA] Temperature measurement byi) Colorii) Segar cones,iii) Tempil pellets or tempil sticksB] Thermometers-Metal expansion, liquid expansion, gas expansion,electrical resistance thermometers.C] Thermocouples –Thermoelectricity, See beck effect, Constructionof thermocouples, Types of thermocouples- Noble metal,thermocouples, Base metal thermocouples. Chromel/Alumel,Iron/Constantan, Copper/ConstantanD] Indirect methods of temperature measurements-i) Optical pyrometer- Construction, working and applications.ii) Total radiation pyrometer- Construction, working andapplications.iii) Resistance pyrometer-Principles, construction, application.	08	16

Specification Table for setting question paper for semester end theory paper:

Sr	Торіс	Dis	tribution of N	Course	Total	
no		Remember	Understand	Application	Outcome	Marks
1	Refractories	08	02	02	MTF309-1	12
2	Introduction To Furnaces	10	03	03	MTF309-2	16
3	Miscellaneous furnaces	08	02	02	MTF309-3	12
4	Electric Furnaces	10	03	03	MTF309-4	16
5	Melting of Nonferrous	06	01	01	MTF309-5	8
	Materials					
6	Pyrometry	10	03	03	MTF309-6	16

Sr.	Name of	Skills developed	Course Outcome
No.	Practical/Experiment/Assignment		
1	Study of properties and applications of different furnace refractories.	Use of proper refractories for different furnaces	MTF309-1
2	Study of construction of fuel fired furnace.	Understand the working principle and construction of fuel fired furnace	MTF309-2
4	Study of various arc furnace and induction furnace.	Understand the working principle and effective melting	MTF309-4
5	Study of furnaces used for non ferrous metals.	Selection of proper furnace for melting	MTF309-5
6	Study of types of Pyrometers	Measurement of temperature of furnace by Pyrometry	MTF309-6

List of Practical's/Experiments/Assignments:

Text Books:

Sr. No	Author	Title	Publication
1	O.P.Gupta	Element of Fuels, Furnace & Refractories	Khanna Publishers
2	T.V.Ramana Rao	Metal Casting principles and practices	New age international publishers
3	P.L.Jain	Principles of foundry technology	McGraw Hill Education(India)Private ltd, New Delhi

Sr. No	Author	Title	Publication
1	D.N.Nandi	Handbook On Refractories	Tata McGraw Hill Co. Ltd.
2	S. Sarkar	Fuels & Combustion	Orient Longmann Mumbai 1990
3	Trinks, Mawhinney, Shannon, Reed & Garvey	Industrial Furnace Vol. I & II	
4	Heine, Loper & Rosenthal	Principal of Metal Casting	

Reference Books:

Instructional Strategy:

Sr. No.	Торіс	Instructional Strategy
1	Refractories	Class room teaching, practical work, group discussion and industrial visits.
2	Introduction To Furnaces	Class room teaching, industrial visits
3	Miscellaneous furnaces	Class room teaching, group discussion and industrial visits.
4	Electric Furnaces	Class room teaching, expert lectures
5	Melting of Nonferrous Materials	Class room teaching, expert lectures group discussion and industrial visits.
6	Pyrometry	Class room teaching, group discussion and industrial visits.

Learning Resources: Models, charts, structures, slides and photographs.

COURSE ID:

Course Name	: Metal Working Processes
Course Code	: MTF310
Course Abbreviation	: FMWP

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

	Progressive A	Assessment	Semester end		
Component	Theory	Term work	Theory	Oral	
Duration	Average of two tests of 20 marks each	As per proforma- III	One paper (3 hours)		
Marks	20	25	80	25	

Rationale:

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

COMPETENCY:

Apply various methods of manufacturing to produce desired shape and size in the components.

Cognitive: Describe various manufacturing processes with the equipments and process details.

Psychomotor: Drawing sketches of different equipment set up used in metal working.

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

Course Outcomes:

- MTF 310-1 Use the fundamentals of metal forming in monitoring the metal working processes
- MTF 310-2 Use the terminologies, engineering fundamentals and process parameters of metal working in producing rolled products
- MTF 310-3 Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by wire drawing
- MTF 310-4 Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by forging
- MTF 310-5 Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by extrusion
- MTF 310-6 Use the terminologies, engineering fundamentals and process parameters of metal working in producing products by sheet metal working

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

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

				Prog	gramme	Outco	mes PO	s and F	SOs				
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Experi ments and practic e	PO 4 Engin eering Tools	PO 5 The engine er and societ y	PO 6 Enviro nment and sustai nabilit y	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Comm unicati on	PO 10 Life- long learni ng	PSO1 Role of Metall urgist	PSO2 Safety and cleanli ness	PSO3 Recyc ling
Competency: Apply various methods of manufacturing to produce desired shape and size in the components	3	3	2	3	1	2	1	2	3	3	3	3	2
MTF 310-1	3	3	-	3	1	3	1	1	2	2	3	3	-
MTF 310-2	3	3	2	3	-	3	1	2	2	2	2	3	3
MTF 310-3	2	3	3	1	1	-	2	1	1	1	2	3	3
MTF 310-4	3	3	2	2	3	-	2	1	1	2	2	3	3
MTF 310-5	3	2	1	3	-	2	1	1	2	2	3	3	2
MTF 310-6	3	3	2	1	3	-	2	1	1	2	2	3	3

COURSE CONTENTS:

Section I

Sr.	Topics	Teaching	Theory
no	Subtopics	(Hours)	Marks
MTF 3	310-1 Use the fundamentals of metal forming in monitoring the metal v	vorking proc	esses.
1.	Introduction: Metal forming, Classification of metal forming processes, Types of stress systems, Elastic & Plastic deformation. Effect of plastic deformation on structure and properties & grain structure. Hot working and Cold working Preheating the steel: Soaking pits, Continuous furnaces	06	12
MTF 3 in prod	310-2 Use the terminologies, engineering fundamentals and process par ducing rolled products.	rameters of i	netal working
2.	 Rolling of metal: Principles of rolling, Classification of rolling mills- based on roll stand design (two high, three high, four high, planetary mill), based on temperature and based on products. 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. Rolling Mill construction, Auxiliary equipment, Plant layout, Roll pass design- various passes, typical roll pass sequence for standard sections. Rolling of tubes. Defects due to process & metal structure. 	10	16
MTF 3	310-3 Use the terminologies, engineering fundamentals and process par	rameters of i	netal working

Sr.	Topics	Teaching	Theory				
no	Subtopics	(Hours)	Marks				
MTF 3	310-1 Use the fundamentals of metal forming in monitoring the metal v	working proc	cesses.				
1.	Introduction: Metal forming, Classification of metal forming processes, Types of stress systems, Elastic & Plastic deformation. Effect of plastic deformation on structure and properties & grain structure. Hot working and Cold working Preheating the steel: Soaking pits, Continuous furnaces	06	12				
MTF 3 in prod	MTF 310-2 Use the terminologies, engineering fundamentals and process parameters of metal working in producing rolled products.						
in prod	ducing products by wire drawing						
3.	 Drawing of wire and rod: 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. Drawing Dies- Material, design, various zones. Wire drawing machines- Draw benches, chain type and bull block draw benches, Multiple pass (continuous wire drawing) Sink drawing and tube drawing, types of mandrels. Patenting- Treatment cycle, advantages, disadvantages, applications. Defects due to process & metal structure. 	08	12				

Section II

Sr	Topics	Teaching	Theory
no.	Subtopics	(Hours)	Marks
MTF 3 workin	310-4 Use the terminologies, engineering fundamentals and proce og in producing products by forging	ss parameter	s of metal
	Forging of metals:		
Δ	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.		
· ·	Forging die design considerations, applications of forging. 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.	10	16
MTE	Forging defects due to process & metal structure.	d nucleos no	nameters in
prodi	cing products by extrusion.	a process pa	rameters in
5.	 Extrusion of metals: Introduction, methods of extrusion- Direct extrusion, Indirect extrusion. Design of extrusion die, lubrication, variables in extrusion. Tube extrusion, Impact extrusion, Hydrostatic extrusion machines, mandrels, containers and lubricants. Applications of extrusion. Defects due to process & metal structure. 	07	12
MTF produ	310-6 Use the terminologies, engineering fundamentals and proc acts by sheet metal working.	ess paramete	rs in producing

6.	Sheet metal working: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.Bending- Clearance between punch and die, spring back, bending with stretching, rubber pad bending, lubrication in bending.Deep drawing, applications of sheet metal working.	07	12
	Total	48	80

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:

Sr.	Торіс	Distrib	oution of m	Course Outcome	Total	
No.		Knowledge	Compre	Applicat	Outcome	
			hension	ion		
1	Introduction	6	3	3	MTF 310-1	12
2	Rolling of metal	8	4	4	MTF 310-2	16
3	Drawing of wire and rod	6	3	3	MTF 310-3	12
4	Forging of metals	8	4	4	MTF 310-4	16
5	Extrusion of metals	6	3	3	MTF 310-5	12
6	Sheet metal working	6	3	3	MTF 310-6	12

Total	40	20	20	80	
					ĺ

List of Practicals:

Sr. No.	Laboratory experiment			Skills develop	bed	Co Out	ourse comes
1	Demonstration of rolling process by using prototype two high mill.			Identify the products manufactured by rolli	ng	MT	F 310-2 As ess me
2	Drawing of rods of aluminum and copper			Perform wire drawing manually or mechanic	g operation cally	MT	F 310-3
3	Demonstration of various forging operations and other forging equipments such as hammers, presses, dies			Identify the products manufactured by forg forging operations.	ing and	MT]	F 310-4 Ter m Wo rk:
4	Demon process	stration of by using v	extrusion videos.	Identify the products manufactured by extrusion		MT	F 310-5
5	Demonstration of various Sheet metal processes.			Identify the sheet meta operations to manufac product.	al cture any	MT	F 310-6
		Sr. No.	Criteria		Marks allot	ted	
	1 Attendance a		at regular practical	2.5			
	2Preparedness3Correct figure		s for practical	5			
			res / diagrams	5			
	4 Observation			tables	5		

4	Observation tables	5
5	Result table / calculations / graphs	5
6	Safety / use of proper tools	2.5
	Total	25

Instructional Strategy:

Sr. No.	Tonia	Instructional strategy
	Topic	Instructional strategy
1.	Introduction	Lecture method
2.	Rolling of metals	Lecture method
		Demonstration method
3.	Drawing of wire and rod	Lecture method
		Group discussion method
4.	Forging of metals	Lecture method
		Industrial visit
5.	Extrusion of metals	Lecture method
		Demonstration method
6.	Sheet metal working	Lecture method

Text-books:

Author	Title	Publisher
George E. Dieter	Mechanical Metallurgy	McGrawhill International Book Co.
V. Masterov, V. Berkovsky	Theory of Plastic deformation & metal working.	MIR Publication

Reference books:

Author	Title	Publisher
Claud, Pearson & Parkins	The Extrusion of metals.	Chapman and Hall, London.
K.Burtsev	Rolling Practice	MIR Publication

P.Polukhin, N.Fedosov, A.Korolyov, Y.Matveyer	Rolling Mill Practice	MIR Publication
Raymond A. Higgins	Engineering Metallurgy	English University Press.
S. E.Rusinoff	Forging & Forming Metals.	D.B.Taraporewala & Sons.
ASS Book	Making Shaping & Treating of Steel	American Society for Steel.

COURSE ID:

Course Name	: Seminar
Course Code	: MTF 311
Course Abbreviation	: ESEM

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	NIL	02
Practical	02	

Evaluation Scheme:

	Progressive Assessment		Semester end	
Component	Theory	Practical	Term work*	Oral ^{**}
Duration	Two tests (1hour each)	One practical (2hours)		
Marks	NIL	NIL	25	25

Rationale:

Most of the engineering activities fall within the category of seminar requiring individual or group decisions, variety of solutions. The purpose of providing seminar in the curriculum is to expose

the students to such situations so that they can gain confidence in taking decisions and taking their problem on their own. The emphasis on the project work must shift from teacher centered to student-centered activities and the creative ability of the student to come forward.

A technician should be able to effectively communicate in writing and orally. Proper group functioning is a prerequisite for maximizing output from a problem- solving group in work environment. Proper organization seminar should be able to stimulate such a continuation so that the students are able to work effectively work in a group and thus gain confidenc3e to effectively take up responsibilities in their careers.

Objectives:

The student will be able to-

- Identify, analyze & define the problem.
- Generate alternative solutions to the problem identified.
- Compare & select feasible solutions from alternatives generated.
- Design, develop, manufacture & operate equipment/Program.
- Acquire higher-level technical knowledge by studying recent development in mechanical engineering field.
- Compare machines/devices/apparatus for performance practices.
- Work effectively in team.

SEMINAR

Every student will prepare & deliver the seminar. Evaluation of seminar will be carried

out by

panel of at least three teaching staff from mechanical/ production /automobile department.

1. Selection of topic for the seminar should be finalized in consultation with teacher guide allotted for the batch to which student belongs.

- 2. Seminar report should be of min.10 & max. 20 pages & it should be certified by guide teacher and head of the department
- 3. for presentation of seminar, following guide lines are expected to be followed:
 - a) Time for presentation of seminar : 7 to 10 minutes /student.
 - b) Time for question/answer : 2 to 3 minutes /student.
 - c) Evaluation of seminar should be as follows:

Presentation: 15 marks

Use of A.V.aids: 05 marks

Question /answer: 05 marks

Total: 25marks

- d) Use of audio visual aids or power point presentation is desirable.
- 4. Topic of the seminar should not be from diploma curriculum
- 5. Seminar can be on project selected by batch.

Criteria for Continuous Assessment of Project Work :

Sr. no	Criteria	Marks allotted	
1	Attendance at regular practical	05	
2	Preparedness for practical	04	
3	Correct figures / diagrams	05	
4	Observation tables	05	
5	Result table / calculations / graphs	02	
6	Safety / use of proper tools	02	
7	Participation in project work	02	
	Total	25	

Instructional strategies:
- 1) Lectures and discussions.
- 2) Laboratory experiences and laboratory interactive sessions.
- 3) Time bound assignments.

Criteria for assessment at semester end Term Work:

Sr. No.	Criteria	Marks allotted
1	Correct figures / diagrams	05
2	Observation tables	05
3	Result table / calculations / graphs	10
4	Safety / use of proper tools / workmanship	05
	Total	25

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

MPECS 2016 DEPARTMENT OF METALLURGY LEVEL 4

Sr No	Name of Course	Course Code			
	Level 4: Applied Tech	hnology Courses			
1	Physical Metallurgy	Π	MTF401		
2	Foundry Technology	Foundry Technology II			
3	Failure Analysis & se	MTF403			
4	Powder metallurgy	MTF404			
5	Project	MTF405			
6	Metal joining and Sp processes	MTF406			
7	In –plant training		MTF407		
		Non-Conventional Energy Sources	MTF408		
8	Elective 1- Group A	Energy Conservation &Audit	MTF409		
		MTF410			

GOVERNMENT POLYTECHNIC, KOLHAPUR

COURSE ID:	
Course Name	: Physical Metallurgy-II
Course Code	: MTF 401
Course Abbreviation	: FPMT- II

TEACHING AND EVALUATION SCHEME: Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	05

Evaluation Scheme:

	Progressive Assess	Term	Total		
Component	Theory	Oral	Theory	Term Work	
Details and Duration	Two tests of 20 marks (one hour each)		Term End Theory Exam (04 hours)	As per Proforma -III	
Marks	20	25	80	25**	150

Rationale:

Phase transformations play very important role in improving the properties of alloys. Heat treatments are used to produce the desired phase transformations. This course covers the details of principles and other process details all important basic heat treatments used for ferrous and non ferrous alloys.

COMPETENCY:

Designing heat treatment cycle referring TTT curve of the candidate material and monitoring the cycle

Cognitive: Understanding & applying principles of phase transformation to obtain desired microstructure

Psychomotor: Operating heat treatment furnace.

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

- MTF 401-1 Identify the products of phase transformation and design the heat treatment cycles accordingly as per requirements of properties.
- MTF 401-2 Use annealing and normalizing heat treatment to obtain desired properties in steels
- MTF 401-3 Use different type of Heat treatment furnaces & Quenching media.
- MTF 401-4 Use tempering treatments to achieve desired properties such as eliminate thermal stresses ,increase toughness etc.
- MTF 401-5 Use hardenability to identify cooling rates necessary to achieve hardening of steels.
- MTF 401-6 Use case and surface hardening treatments to increase the hardness and wear resistance of the surfaces.
- MTF 401-7 Use heat treatments to modify properties of cast irons.
- MTF 401-8 Use heat treatments to alter properties of non ferrous metals
- MTF 401-9 Use safety measures in heat treatments to prevent any harmful effects.

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

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

				Prog	gramme	Outcon	mes PO	s and P	SOs				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2	PSO3
Competency	Basic	Discip	Experi	Engin	The	Enviro	Ethics	Indivi	Comm	Life-	Role	Safety	Recyc
and	knowl	line	ments	eering	engine	nment		dual	unicati	long	of	and	ling
Cos	edge	knowl	and	Tools	er and	and		and	on	learni	Metall	cleanli	
		edge	practic		societ	sustai		team		ng	urgist	ness	
			e		У	nabilit		work:					
						У							
Competency: Designing heat treatment cycle referring TTT curve of the candidate material and monitoring the cycle	3	3	2	3	2	2	2	2	3	3	3	2	2
MTF 401-1	3	3	2	3	2	3	2	2	2	2	3	3	-
MTF 401-2	3	3	2	3	2	3	1	2	2	2	2	3	3
MTF 401-3	2	3	3	2	2	2	2	2	2	2	2	3	3
MTF 401-4	3	3	2	2	3	2	2	2	2	2	2	3	3
MTF 401-5	3	3	2	3	2	2	2	2	2	2	3	3	2
MTF 401-6	3	3	2	2	3	2	2	2	2	2	2	3	3
MTF 401-7	3	3	2	3	2	2	2	2	2	2	3	3	2

	Section I					
Sr. no	Topics/ Subtopics	Lecture (Hours)	Theory Evaluation Marks			
MTF 4 accora	01-1 Identify the products of phase transformation and designingly as per requirements of properties.	gn the heat tre	atment cycles			
1.	Transformations of steels on heating: Critical Points. Transformation of pearlite to austenite upon slow heating, Mechanism and kinetics of transformation, Austenitic grain size .Determination ,measurement and importance of austenite grain size Transformations of steels on cooling: 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 Mechanism and kinetics of transformation of austenite to Bainite. upper and lower bainite , Comparison with martensitic and pearlitic transformation	10	16			
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	04	08			
MTF 4	Comparison with annealing. 01-3 Use different type of Heat treatment furnaces & Quence	hing 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.	06	10			

Sr. no	Topics/ Subtopics	Lecture (Hours)	Theory Evaluation Marks
MTF 4	01-4 Use tempering treatments to achieve desired properties	s such as elimi	nate thermal
stresse	s ,increase toughness etc.		
	Tempering Of Steel:	04	06
4	Objectives of tempering -Structural changes during		
	tempering, Classification of tempering, .Effect of		
	tempering temperature on mechanical properties .Temper		
	embrittlement, Secondary hardness, Self tempering		

Section II

Sr. no.	Topics/ Subtopics	Teaching (Hours)	Theory evaluation Marks
MTF 4	01-5 Use hardenability to identify cooling rates necessary t	o achieve hard	lening of
sieeis.	Hardenability of steel		
5	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.	06	08
MTF - wear	401-6 Use case hardening and surface hardening treatments resistance of the surface.	to increase th	e hardness and
6	 Case Hardening Of Steel: Carburising – pack, gas and liquid carburizing. H. T. after carburizing. a) Nitriding – Tufftriding b) Cyaniding–Carbonitriding Diffusion metallizing, Plasma Nitriding Process, Advantage, Limitation & Application 	06	10
7	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 401. These heat treatments to modify properties of east increase	05	08
<i>IVI I I'</i>	401-7 Use near treatments to moally properties of cast frons.		
8	Heat Treatment Of Cast Irons: H. T. of grey C. I., White C. I., Malleable C.I., H. T. of S. G. Irons etc.	02	04
MTF	401-8 Use heat treatments to alter properties of non ferrous	metals	
9	Heat Treatment of Non-ferrous Metals And Alloys:	04	08

	Effect of annealing on cold working metals – H. T. of Al,		
	Copper and Mg alloys.		
	Precipitation hardening of Al-Cu system		
	Conditions, steps, variables, theories.		
	G P Zone theory, coherent lattice theory.		
MTE	401 0 U	harmful offact	c
1/1 1 1	401-9 Use safety measures in neat treatments to prevent any	паттја ејјеси	
<i>W</i> 111 ⁻	401-9 Use safety measures in neat treatments to prevent any	narmjui ejjeci.	
10	Safety Measurements In H. T. Shop:	01	02
10	Safety Measurements In H. T. Shop: Environmental control in H. T. shop.	01	02
10	Safety Measurements In H. T. Shop: Environmental control in H. T. shop. Safety rules & precautions in H. T. Shop	01	02
10	Safety Measurements In H. T. Shop: Environmental control in H. T. shop. Safety rules & precautions in H. T. Shop	01 48	02
10 Semes	Safety Measurements In H. T. Shop: Environmental control in H. T. shop. Safety rules & precautions in H. T. Shop ster end exam question paper should be such that total marks	01 48 s of questions of	02 80 on each topic is
10 Semes one an	Safety Measurements In H. T. Shop: Environmental control in H. T. shop. Safety rules & precautions in H. T. Shop ster end exam question paper should be such that total marks and half times the marks allotted above but the candidates are	01 48 s of questions o e able to attemp	02 80 on each topic is pt questions of

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

Section	Distribution of marks (Cognitive level- wise)				Course Outcome	
/ Topic no.	Name of topic	Remember	Understand	Application		Total marks
I/1	Transformations In Steels	04	06	06	MTF 401-1	16
I/2	Annealing and Normalizing	02	02	04	MTF 401-2	08
I/3	Hardening Heat Treatment	02	02	06	MTF 401-3	10
I/4	Tempering Of Steel	02	02	02	MTF 401-4	06
II/5	Hardenability Of Steel	02	02	04	MTF 401-5	08
II/6	Case Hardening Of Steel	02	02	06	MTF 401-6	10
II/7	Surface Hardening Of Steels And C.I.	02	02	04	MTF 401-6	08
II/8	Heat Treatment Of Cast Irons	02	02	00	MTF 401-7	04
II/9	Heat Treatment of Non- ferrous Metals And Alloys:	02	02	04	MTF 401-8	08
II/10	Safety Measurements In H. T. Shop	02	00	00	MTF 401-9	02

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.

B) TERM WORK Term work shall consist of the following :

Laboratory experiments and related skills to be developed :

Sr. no	Laboratory experiment	Skills developed	Course Outcome
1	Study of heat treatment furnaces	Operation of het treatment furnaces	MTF 401-1
2	Study microstructure of steels after annealing and normalizing.	Undertake annealing and normalizing treatments	MTF 401-2
2	 (a)Hardening – effect of quenching medium (b)Hardening – effect of hardening temperature. (c)Hardening – effect of composition 	Undertake hardening treatment of steels	MTF 401-3
3	 Tempering – effect of tempering temperature. Tempering – effect of tempering time. 	Undertake tempering treatment of steels	MTF 401-4
4	Hardenability of steel	Carry out Jominy end quench test	MTF401-5
5	Heat treatment of cast irons	Undertake hardening treatment of cast irons	MTF 401-7
6	Precipitation hardening of aluminum copper alloys.	Undertake precipitation hardening of Al –CU alloys.	MTF 401-8
7			

Instructional Strategy:

Sr No	Торіс	Instructional Strategy
1	Transformations In Steels	Class room teaching, practical work, Group
		discussion and industrial visits.
2	Annealing And Normalizing	Class room teaching, industrial visits
3	Hardening Heat Treatment	Class room teaching
4	Tempering Of Steel	Class room teaching
5	Case Hardening Of Steel	Class room teaching, expert lectures
6	Surface Hardening Of Steels & C. I. :	Class room teaching, expert lectures group
		discussion and industrial visits.
7	Heat Treatment Of Cast Irons	Class room teaching
8	Heat Treatment Of Non-Ferrous Metals	Class room teaching, expert lectures
	And Alloys	
9	Safety Measurements In H. T. Shop	Class room teaching

Textbooks:

Author	Title	Publisher
Clark & Verney	Physical metallurgy for engineers	CBS publishers and distributors
Avner	Introduction to Physical Metallurgy	Tata Mc Graw Hill Publishing
		Company Ltd, New Delhi.
Higgins	Physical metallurgy	English University Press, London

Reference Books:

Author	Title	Publisher
	ASM Handbook	American Society of Metals
Prabhudeva,	Heat treatment handbook	Tata McGraw Hill Co. Ltd.

Learning Resources: Models, charts, structures, slides and photographs

COURSE ID:

Course Name	: Foundry Technology-II
Course Code	: MTF 402
Course Abbreviation	: EFTH- II

TEACHING AND EVALUATION SCHEME:

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	3	-
Practical	2	5

Evaluation Scheme:

Mode of	Progress	ive Assessment	Term End Ex		
Evaluation	Theory	Practical	Theory Examination	Term Work	Total
Details of Evaluation	Average of two tests of 20 marks each	 i. 25marks for each practical ii. One PST of 25 marks 	Term End Theory Exam (3 hours)	As per proforma-	
Marks 20 each		25	80	25	150

*Assessment as per proforma IV: includes the marks of Continuous assessment (TW), Progressive skill test and term end oral/practical.

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 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 defect. The skill of identifying the defect ,its causes will help in producing good casting.

Competency:

Use casting designing, foundry practices, defect analysis to produce sound casting and increase productivity.

Cognitive: Understanding & applying principles of failure analysis and selection of materials.

Psychomotor: i) Preparation of specimen for microstructure analysis of failed components

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

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

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

				Progr	amme	Outcor	nes PO	s and I	PSOs				
Competency and Cos	PO 1 Basic knowle dge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 The engin eer and societ	PO 6 Envir onme nt and sustai	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safety and cleanl iness	PSO3 Recyc ling
					У	nabili ty							
Competency: Fulfill the job of supervisor in ferrous or non ferrous foundry	3	3	2	3	1	2	1	2	2	3	3	3	2
MTF 402-1	1	1	3	2	1	3	1	2	2	2	3	3	-
MTF 402-2	1	1	2	3	3	2	2	2	2	2	2	3	3
MTF 402-3	3	3	2	3	3	3	2	2	2	2	2	3	3
MTF 402-4	3	3	2	3	3	3	2	2	2	2	2	3	3
MTF 402-5	2	2	3	2	2	3	3	3	1	1	1	3	2
MTF 402-6													

COURSE OUTCOMES:

MTF 402-1 Use the basic laws and principles of fluid mechanics governing the flow of liquid metal for deigning an elementary gating system for simple casting.

MTF 402-2 Design an elementary gating system for simple casting.

MTF 402-3 Use the principles of risering design to identify hot spot s in the casting and develop size and shape of risers to achieve directional solidification by using necessary aids

MTF402-4 Control process parameters for producing sound ferrous castings

MTF402-5 Control process parameters for producing sound nonferrous castings

MTF402-6 Identify defect in casting, find its causes and take appropriate measures to correct it

Section I

Sr. no	Topics Subtopics	Teaching (Hours)	Theory Marks
MTF 4	402-1 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, Raynauld's No. Step involved in the design of the gating area. Calculation of pouring time, Sprue exit area, Runners, Risers & Ingates for Ferrous and Non Ferrous alloys. Importance and determination of dimensions of passages. i.e. gating ratio,	8	10
MTF 4	02-3 Use the principles of risering design to identify hot spot s in the size and shape of risers to achieve directional solidification b	he casting and by using neces	develop sary aids.
2	Risering of casting Directional solidification, riser shape, size and location, riser neck. Chvorinov's rule, Cain's method, Modulus method, Inscribed circle method, Concept of directional solidification, use of padding, exothermic material, sleeves and chills to achieve directional solidification,	8	10
MTF4	02-4 Control process parameters for producing sound ferrous castin	igs	
3	Foundry practice of Grey Cast Iron and S G Iron Charge composition, molding practice for Grey C.I., Chill Test, Carbon Equivalent, Use of C.E. meter, Chill test, Effect of Inoculation S.G. Iron Technology Charge composition, Various techniques of S.G. iron Production, Mg recovery, Molding practice for S.G. iron, Analysis of type of nodule, nodule count, nodule size, nodularity, Austempered Ductile Iron.	6	12
4	Production of steel casting Specific Characteristic of steel castings, melting practice, Molding practice, Alloying practice for steel casting		08
Semes	ter end exam question paper should be such that total marks of qu	uestions on ea	ach topic is
one an	d half times the marks allotted above but the candidates are able to	attempt ques	tions of the
above	allotted marks only.		

	Section II		
Sr. No	Topics Subtopics	Teaching (Hours)	Theory Marks
MTF40	2-5 Control process parameters for producing sound nonferrous ca	stings	
5	Foundry practice for Aluminum and Magnesium alloys. Production of Al and Al alloys, Al casting alloys, Modification of Al-Si alloys Metal treatment Degassing, fluxing, vacuum degassing, ultrasonic treatment	6	12
6	Production of Cu and Cu alloy castings Moulding, Gating and riser design, Melting, Deoxidation Drossing, , Oxygen and Hydrogen in Cu melt,	4	08
MTF40	2-6 Identify defect in casting, find its causes and take appropriate n	neasures to co	orrect it
7	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	4	16
8	Energy Efficieny in foundries		
Semester and hal above a	er end exam question paper should be such that total marks of questing f times the marks allotted above but the candidates are able to a llotted marks only.	ions on each t attempt questi	opic is one ons of the

Specification 7	Fable:
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Sr.No	Topics				COURSE OUTCO	TOTAL
			Comprehens	Applicatio	ME	
			ion	n		
1	Flow Of Metals & Gating	4	3	5		12
	System					
2	Risering Of Castings	2	2	3		07
3	Foundry practice of Grey	2	2	2		06
	Cast Iron and S G Iron					
4	Production of steel casting	6	3	5		14
5	Foundry practice for	4	6	-		10
	Aluminum and					
	Magnesium alloys.					

Sr. no	Laboratory exper	rience	Skills developed			
01	Study of various typ gates.	bes of	 Use the functions of the Ingates in the filing of mould. Use the nature of the flow in designing of the Ingate Use types of the gating systems to suit the requirem 	the es. ent		
02	 Use shrinkage behavior of the metal. Use types of the risers to suit the requirements of feeding. Determine size & shape of the risers effect feeding. 	the				
03	Case study of design of gating system and riser		 Follow the steps involved in the design of the sprue runner & risers. Calculate the elements of the gating system. location & joining of the gating system to the casting. 			
04	Study of various me of the S.G.Iron prod	thods luction.	 4) Use various types of methods of S.G. production. 5) Compare various methods of S.G. Iron production 6) Produce the desired microstructure in terms of not type, size, nodularity 	Iron dule		
05	Crucible Melting of	Al	1) related with the melting of Al & care to be taken avoid these problems.	n to		
06	6 Study of the modification of the Al-Si. Alloys.		2) Undertake modification of Al –Si alloys			
Production of Cu and Cu 4 alloy castings		4	4 -	8		
Production of steel casting 2		2	4 4	10		
Casting Defect Analysis						

Laboratory experiences and related skills developed

Text Books:

6

7

8

Author	Title	Publisher		
T.V.Ramana Rao	Metal Casting Principle and	New Age International (P) Ltd.,		
	Practice	Publishers		
P.L. Jain	Principles Of Foundry Technology.	Tata McGraw Hill Publishing		
		Company, New Delhi.		
Richard W.Heine, Carl	Principle Of Metal Casting.	Tata McGraw Hill Publishing		
R.Loper, Philip C.		Company, New Delhi.		
Rosenthal				

Sr.No.	Topics	Instructional Strategy
01	Flow of Metals and gating system	Lecture Method, practical.
02	Risering Of Castings.	Lecture Method, Practical.
03	Fettling, Cleaning &H.T. of Castings	Lecture Methods, Industrial visit.
04	Melting Practice Metallurgy of C.I.	Lecture Method, Industrial Visit.
05	S.G. Iron Technology	Lecture Methods, Industrial visit.
07	Production of steel casting	Lecture Methods, Industrial visit.
08	Foundry practice for Aluminum alloys.	Lecture Method, Practical.
09	Production of Cu and Cu alloy castings	Lecture Methods
10	Production of Mg &Zn base casting alloys.	Lecture Method.

Instructional Strategy:

COURSE ID:

Course Name	: Failure Analysis and Selection of Materials
Course Code	: MTF 403
Course Abbreviation	: EFSM

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	05

Evaluation Scheme:

Component	Prog Asso	gressive essment	Semester end		
	Theory	Term work	Theory	Oral*	
Duration	Two tests (1hour each)	One practical (2hours)	One paper (3 hours)		
Marks	20	25	80	00	

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.

Competency: Analyze engineering failures and select suitable materials to prevent them

Cognitive: Understanding & applying principles of failure analysis and selection of materials.

Psychomotor: Preparation of specimen for microstructure analysis of failed components

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

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

				Pro	gramm	e Outco	omes I	Os ar	nd PSC)s			
Competency and COs	PO 1 Basi c kno wled ge	PO 2 Disci pline know ledge	PO 3 Expe rime nts and pract ice	PO 4 Engi neeri ng Tool s	PO 5 The engine er and societ y	PO 6 Enva nd sustai nabili ty	PO 7 Ethi cs	PO 8 Indi vidu al and team work :	PO 9 Com muni catio n	PO 10 Life- long learnin g	PSO1 Role of Metal lurgis t	PSO2 Safety and cleanli ness	PSO3 Recycl ing
Competency : :Analyze engineering failures and select suitable materials to prevent them	3	3	2	3	2	2	2	2	3	3	3	2	2
MTF 403-1	2	3	1	3	2	3	2	1	2	2	3	3	-
MTF 403-2	2	3	1	3	2	3	2	1	2	2	2	3	3
MTF 403-3	2	3	1	3	2	3	2	1	2	2	2	3	3
MTF 403-4	2	3	1	2	3	3	2	2	2	2	2	3	3
MTF 403-5	3	2	1	3	2	2	2	2	2	2	3	3	2
MTF 403-6	3	2	1	3	2	2	2	2	2	2	3	3	2

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

Course outcomes:

MTF 403-1 Prepare failure analysis report for a simple type of failure

MTF 403-2 Identify types of failure, their causes.

MTF 403-3 Use concept of fracture mechanics in designing the engineering components and selection of materials.

MTF 403-4 Identify common failures and prevention methods.

MTF 403-5 Apply all the selection factors in the material selection process.

MTF 403-6 Select suitable materials according to their properties.

MTF 403-7 Recommend suitable steel according to the requirement.

Course Content:

Sr. No.	Topic / Subtopic	Hours	Marks				
	Section I						
MTF 4	MTF 403-1 Prepare failure analysis report for a simple type of failure						

1.	Introduction to Failure Analysis Categories of Stressors – Mechanical, Chemical, Spectrochemical, Thermal, Radiation, Electrical Types of failure – Distortion, fracture, corrosion, wear Steps in investigation of failure – Collecting information, question to be raised in examination of failure Preparation of failure analysis report	04	08
MTF 4	03-2 Identify types of failure, their causes.		
2.	Failure Analysis Types of fractures-Ductile and Brittle fracture, Comparison between ductile and brittle fracture, ductile to brittle transitions in steels. Causes of failure-stress and strength, types of loading, fatigue fractures ,effect of stress raisers, effect of strength reducers, effect of residual stresses ,bending fractures, torsional failures, other variables	06	10
MTF 4 selectio	03-3 Use concept of fracture mechanics in designing the engine on of materials.	neering com	ponents and
3	Fracture Toughness Modes of fractures, Use of fracture toughness to predict performance of components, plain strain fracture, critical crack size, crack growth under cyclic loads. (simple numericals) Fracture Mechanics Finite element stress analysis, flaw detection, commonly used NDT techniques	06	10
MTF 4	03-4 Identify common failures and prevention methods.		

4	Failure Prevention Preventing wear failures-Abrasion ,low stress, metal-to metal wear, surface fatigues, Nonmetal sliding wear, corrosive wear/Erosion, solid particle erosion, preventing corrosion failure-common problems and preventive measures, underground piping, underdeposit attack, water circulating systems, pil sumps, corrosion in storage, coatings, stress corrosion cracking(SCC),Environmentally assisted cracking, Intergranular corrosion, high temperature oxidation, galvanic corrosion, dealloying, welding, passivating, corrosion fatigue, erosion corrosion, aging, handling seawater, corrosion allowances Preventing mechanical Failures Stress concentrations, fracture resistance ,stress-strain data, impact strength, fatigue strength	08	12
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Section II

MTF 4	03-5 Apply all the selection factors in the material selection	process.	1
4	Introduction	04	06
	Role of material selection in design process		
	Material selection factors-Properties, Availability,		
	Economics, Business issues		
	Materials for machine components (Budinski)		
	weldability, formability, forgeability.		
MTF 4	03-6 Select suitable materials according to their properties.		
5.	Physical Properties And Selection Of Materials For	06	12
	Various Applications		
	i) Magnetic properties – electrical properties. Selection of		
	materials for electrical application, Hard & Soft Magnets		
	such as Alnico fernico etc.		
	ii) Machinability – concept of machinability, measurement		
	of machinability, machinability index of various metals		
	and alloys.		
	iii) 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.		
6	High Temperature Properties, Corrosion Resistance &	06	12
	Stainless Steels		
	i) High temperature properties – selection of materials		
	for use at elevated temperatures, super alloys.		
	ii) 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		
MTF 4	03-6 Select suitable grade of tool steel according to the requ	irement.	
7	Tools Steels 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.	04	05
MTF 4	03-7 Recommend suitable steel according to the requirement	•	L
8	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.	04	05

Specification Table:

Sr.N o.	Торіс	Kı	nowledge Lev	Course Outcome	Total	
		Cognitive Level	Compre- Hension	Applica- Tion		
1.	Introduction to Failure Analusis	6	6	4	MTF403-1	16
2.	Fracture Toughness	5	5	4		14
3.	Failure Analysis	5	3	2		10
4	Introduction	6	3	3		12
5.	Functional Requirement Of					
	Engg. Materials	6	4	4		14
6.	Steels Selection	6	4	4		14

List of Practicals:

- 1. Study of different types of failures, ductile, brittle, wear, fatigue, corrosion, stress corrosion.
- 2. Case studies of different types of fractures.
- 3. Case studies of selection of materials.

Instructional Strategy:

Sr.No	Торіс	Instructional Strategy
1.	Introduction	i) Lecture method
2.	Functional requirement of Engg.	i) Lecture method
	Materials	
3.	Steel selection	i) Lecture method
		ii) Demonstration method
4.	Fracture toughness	i) Lecture method
5.	Fracture analysis	i) Lecture method

Text – Books:

Author	Title	Publisher
Dieter	Mechanical Metallurgy	McGraw-Hill
		international
Reed-Hill	Physical Metallurgy	East-West Press Pvt.
	Principles	Ltd., New Delhi.

Learning Resources: LCD Projector, Presentation

COURSE	ID	:
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Course Name	: Powder Metallurgy
Course Code	: MTF 404
Course Abbreviation	: FPM

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	3	5
Practical	2	C

Evaluation Scheme:

Component	Progressive Assessment		Seme	Total	
	Theory	Term work	Theory	Oral	
	Two tests	One	One		
Duration	(1hour	practical	paper		
	each)	(2hours)	(3 hours)		
Marks	20	25	80		125

*Assessment as per proforma III :includes the marks of Continuous assessment

(TW), Progressive skill test and term end oral/practical.

RATIONAL:

Powder metallurgy is one of the important techniques of manufacturing metallic components used in several fields of engineering, automotive, atomic energy, defense, high temperature technology etc. This subject deals with the manufacture and uses of components produced by powder metallurgy techniques.

COMPETENCY :

Cognitive: Knowledge of making components by powder metallurgy process.

Psychomotor: Finding density, surface area, flow rate of metal powder.

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

MTF 404-1 Establishing powder manufacturing method than other manufacturing route.

MTF 404-2 Use various powder manufacturing method in industry.

MTF 404-3 To test the powders.

MTF 404-4 Using various compacting method in industry.

MTF 404-5 Using sintering process.

MTF 404-6 Use typical products made by powder metallurgy along with their manufacturing Process.

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

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

		Programme Outcomes POs and PSOs											
Competency and COs	PO 1 Basic know ledge	PO 2 Disci pline know ledge	PO 3 Expe rime nts and pract ice	PO 4 Engi neeri ng Tools	PO 5 The engin eer and societ y	PO 6 Envir onme nt and sustai nabili ty	PO 7 Ethic s	PO 8 Indiv idual and team work :	PO 9 Com muni catio n	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safet y and cleanl iness	PSO3 Recy cling
Competency: Investigation of common engineering failures and find out substitute material to avoid it.	3	3	2	3	2	2	2	2	3	3	3	2	2
MTF 404-1	3	3	1	3	2	3	2	1	2	2	3	3	-
MTF 404-2	3	3	1	3	2	3	2	1	2	2	2	3	3
MTF 404-3	3	3	1	3	2	3	2	1	2	2	2	3	3
MTF 404-4	3	3	1	2	3	3	2	2	2	2	2	3	3
MTF 404-5	3	2	1	3	2	2	2	2	2	2	3	3	2
MTF 404-6	3	2	1	3	2	2	2	2	2	2	3	3	2

CONTENT:

A) THROY:

	Section I		
Sr. no	Topics/ Subtopics	Lecture (Hours)	Theory Evaluation Marks
MT man	F 404-1 Establishing powder manufacturing method bufacturing route.	than other	
1.	Outline: Principles and scope of powder Metallurgy in industry. Comparison of powder method with other shaping or forming methods of production. Principles of the process, its applications, advantages and disadvantages.	6	10
MT	F 404-2 Use various .0powder manufacturing method	l in industr	v.
2.	Powder Production: Production of metal powder: Classification of powder production methods, various methods of powder production such as Grinding, crushing, Milling, Atomization, Condensation, Carbonyl method, Reduction method, Electrolysis etc. Specific characteristics of powder manufactured by each method and applications to various metals and alloys.	12	20
MT	F 404-3 To test the powders.		
3	Powder Conditioning Characteristics And Testing Of Metal Powders: Size, shape and distribution, its measurement, Hall flow meter, Density of metal powders, compressibility and its measurement, surface area and surface energy.	6	10

Section II

Sr. no.	Topics Subtopics	Lecture (Hours)	Theory evaluation Marks
MTF	404-4 Using various compacting method in industry.		
4. <i>MTF</i>	Powder Compacting: Classification of compacting methods and compacting methods such as pressure less shaping methods, cold compacting methods and compacting with heat, brief outline of die punch. Design, ejection methods, lubricants and their use in compacting, component shape design, various presses used for compacting applications., advantages and disadvantages. Special compacting methods such as powder rolling, Isostatic, compacting, explosive forming, cyclic compacting, powder extrusion etc. 404-5 Using sintering process.	12	20
.,			
5	Sintering Of Powder Purpose of sintering, mechanism of sintering process, Liquid phase sintering, controls in sintering, sintering furnaces and atmosphere.	6	10
MTF	404-6 Use typical products made by powder metallurg manufacturing Process.	gy along wit	h their
6	Applications Of Sintered Products Tools materials, Bearing metals, Permeable materials, friction of materials, Magnetic materials and refractory metals etc. Specifications of various sintered products. Manufacture of P/M parts: Cemented carbides, electrical contract materials, sintered metal friction material.	6	10
Seme	ster end exam question paper should be such that	total mark	s of questions
able t	to attempt questions of the above allotted marks only	y.	canuluates are

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

Sectio n /	Name of tonia	Distribution	of marks (Co wise)	Course Outcome	Total	
Topic no.	Name of topic	Remember	Understan d	Application		mark S
I/1	Outline	05	05	-	MTF 404- 1	10
I/2	Powder Production	05	05	10	MTF 404- 1	20
I/3	Characteristic & Testing Of Powder	05	05	10	MTF 404- 1	10
I/4	Powder Compacting	05	05	10	MTF 404- 1	20
II/5	Sintering	-	05	05	MTF 404- 1	10
II/6	Application Of Sintered Products	-	02	08	MTF 404- 1	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. B) TERM WORK Term work shall consist of the following :

Laboratory experiences and related skills developed.

Sr. no	Laboratory experience	Skills developed	Course outcome
1	Study of metal powders – manufacturing various processes of metal powder of Fe, Cu, Al	 To familiarize with the processes of the metal preparation. To understand the techniques of powder preparation. To understand the advantages and disadvantages of the methods of powder preparation. 	MTF 404-2
2	Flow rate of metal powder.	To understand the apparatus used in the measurement of the flow of the powder. To able to measure the flow rate of the powder.	MTF 404-3
3	Apparent density of powder.	Tounderstandthemethodofmeasuring the apparent density of thepowder.Tounderstandtheconceptofapparent density.	MTF 404-3
4	Compaction of metal powders – Compaction of different types of powder in die punch. Effect of load	To study the compaction of the metal powder in the die. To understand the mechanism of compaction of metal powders.	MTF 404-4
6	Study of bearing properties –	To understand the bearing properties	MTF 404-5

Sr. no	Laboratory experience	Skills developed	Course outcome
	Determination of bearing properties of sintered bearing alloys.	of the alloy. To familiarize with the bearing properties of the component.	
7	Visit Report: On Powder metallurgical plant.	To develop the reporting skill .Tounderstandtheoverallmanufacturing process of the powdercompact.	MTF 404-1

C) Instructional Strategy:

Sr.No.	Торіс	Instructional Strategy				
	Section – I					
1	Outline	Lecture method				
2	Powder Production	Lecture method				
3	Characteristics and Testing of Metal	Lecture method				
	Section – II					
4	Powder Compaction	i) Lecture methods				
		ii) Demonstration method				
5	Sintering Of Powders	Lecture method				
6	Application Of Sintered Products	Lecture method				

Text – Books:

Author	Title	Publisher
K. Sinha	Powder Metallurgy	Dhanpat Rai And Sons, Delhi
Sands &	Powder Metallurgy	George Neunes Ltd., London.
Shakespeare		

Reference Books:

	Title	Publisher
Author		
C.G. Goetzel	Treatise On Powder Metallurgy	Interscience Publishers,
		NewYork

Learning Resources: Transparency – O.H.P., Visit To Powder Metallurgical Industry.

COURSE ID:

Course Name	: Project
Course Code	: MTF 405
Course Abbreviation	: EPJT

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory		4
Term work/Practical	4	4

Evaluation Scheme:

	Progressive	Assessment	Semester end			
Component	Theory	Term work**	Theory	Oral**		
Duration	Two tests (1hour each)	Two testsOne(1hourpracticaleach)(2hours)				
Marks		50		50		

*Assessment as per proforma IV: includes the marks of Continuous assessment (TW), Progressive skill test and term end oral/practical.

Course Aim:

The project work is included in the syllabus to encourage the students to undertake and tackle an independent problem related to metallurgical field. The project may also comprise of literature survey of a problem assigned.

Student should be well acquainted with the skill required for independent thinking and applications to a problem where he can develop in himself 'Self Reliance'. He should be able to make use of library.

The project work will be done by a group of 4 to 6 students. The students will select a topic related to any subject in their syllabi and will design and construct the required equipment, carry out tests and trials and they will submit a report of the work done by them in a suitable form. The project may consist of a market survey or a literature survey of recent developments in the field of metallurgy or it may be a study of a metallurgical processes.

Course Contents:

Selection of topic for project work and relevant experimentation, literature survey, interpretation of results. Group discussion and presentation of the project work in writing.

Laboratory Work:

As per the topic selected by student.

Specification Table:

Sr.	Торіс	Knowledge	Cogniti	Cognitive Levels			
No.				Appln.			
1	Oral/Term work	40	30	30	100		

Instructional Strategy:

Literature survey, experiments, trials, group discussion, interpretation of results, discussion with industrial experts.

Reference Books: As per the selected topic for the project.

Learning Resources: Relevant books and experiments.

Skills to Be Acquired By Technician:

Various skills are developed depending on the selected topic. These skills are as follows.

Reading skill, tapping resources including library, using knowledge already acquired, thinking and communication skills, working in groups – leadership. Interactions with industries, developing contacts, meeting people, making survey, cost consciousness, using resources available in other institutes or industries, skill of handling equipment and instruments safety, observing operations critically, skill of recording results and interpretation of results with group discussion, finding solution for problems and quality awareness, presentation of report in writing, participation in exhibition and developing personality and self-confidence.

COURSE ID:

Course Name	: Metal Joining & Special Forming Processes
Course Code	: MTF 406
Course Abbreviation	: EMJF

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	05

Evaluation Scheme :

	Progressive Assess	sment	Term	Total	
Component	Theory	Practical	Theory	Term Work	
Details and Duration	Two tests of 20 marks (one hour each)		Term End Theory Exam (04 hours)	As per Proforma -III	
Marks	20	25**	80	25	150

*** RATIONALE:**

In industries, various parts of engineering components are required to be joined on regular basis. Similarly various old parts need replacement very often. Understanding of different joining methods is very much essential in Metallurgy. Welding, is one of the most important joining techniques, will lay emphasis on different processes of joining of metals and alloys which have been using continuously in industries.

COURSE OUTCOMES:

After completing this course students will be able to-

- 1. Appraise the effects of welding on microstructure of metals and alloys.
- 2. Select different welding processes for various applications.
- 3. Recommend most appropriate welding process for particular application based on different criterions.
- 4. Prepare appropriate joint to perform different welding operation
- 5. Perform various welding processes
- 6. Handle different welding equipments and accessories carefully.

COMPETENCY:

Use fundamentals of metal joining to carry out various joining processes and to understand effects of welding parameters on structures and properties of metals and alloys

Cognitive: Understanding & applying principles of metal joining.

Psychomotor: (i) use welding machines. iii) Preparation of joints for welding (iii) conduct weld tests

Affective: Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES:

After completing this course students will be able to-

MTF406-1 Appraise the effects of welding on microstructure of metals and alloys. MTF406-2 Recommend most appropriate gas welding flames for particular application

MTF406-3 Select different arc welding processes for various applications MTF406-4 Prepare appropriate joint to perform different welding operation MTF406-5 Handle different welding equipments and accessories carefully. MTF406-6 Use appropriate test to find out soundness of weld.

MTF406-7 Select proper modern machining and forming processes.

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

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

				Progra	amme	Outco	mes P	Os and	l PSOs	5			
Competency and Cos	PO 1 Basic know ledge	PO 2 Disci pline know ledge	PO 3 Expe rime nts and pract ice	PO 4 Engi neeri ng Tools	PO 5 The engin eer and societ y	PO 6 Envir onme nt and sustai nabili ty	PO 7 Ethic s	PO 8 Indiv idual and team work :	PO 9 Com muni catio n	PO 10 Life- long learni ng	PSO1 Role of Metal lurgis t	PSO2 Safet y and cleanl iness	PSO3 Recyc ling
Competency: Knowledge of iron and Steel Making	1	3	1	1	2	3	2	2	3	3	3	2	3

				Progra	amme	Outco	mes P	Os and	I PSOs	5			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PSO1	PSO2	PSO3
Competency	Basic	Disci	Expe	Engi	The	Envir	Ethic	Indiv	Com	10	Role	Safet	Recyc
and	know	pline	rime	neeri	engin	onme	S	idual	muni	Life-	of	y and	ling
Cos	ledge	know	nts	ng	eer	nt		and	catio	long	Metal	cleanl	
		ledge	and	Tools	and	and		team	n	learni	lurgis	iness	
			pract		societ	sustai		work		ng	t		
			ice		У	nabili		:					
						ty							
MTF 406-1	1	3	1	2	2	2	2	2	2	2	3	3	-
MTF 406-2	1	3	2	3	-	3	1	2	2	2	2	3	3
MTF 406-3	1	3	2	3	2	1	2	2	2	2	2	3	3
MTF 406-4	1	3	2	2	3	2	2	1	2	2	2	2	2
MTF 406-5	1	3	2	2	2	2	2	2	2	2	3	3	2
MTF 406-6	1	3	2	2	3	2	2	2	2	2	2	3	3
MTF406-7	1	2	2	3	2	2	1	2	2	2	2	2	3

CONTENT:

A. THEORY :

SECTION-I

Sr. no	Topics Subtopics	Teaching (Hours)	Theory Marks
MTF4	06-1 Appraise the effects of welding on microstructure	of metals and	d alloys.
1.	INTRODUCTION Various metal forming processes. Metal joining methods, welding, brazing, soldering requirements and classification of Welding processes, Metallurgical changes occur in welding	02	04
applic	wo-2 Recommend most appropriate gas welding fla eation	ames for par	ticular
2.	GAS WELDING Materials & Equipment, Fuel Gases and their characteristics, availability, welding flame, welding Torches classification, filler materials, fluxes. Gas Welding Techniques, Oxy-acetylene welding, Torch angle, heat input, Nature of Flame & Its applications,	10	16
MTF4	106-3 Select different arc welding processes for vario	ous application	ons
3 MTF4	Arc Welding Process Electric arc properties, Equipment for arc welding, Requirement of welding generator & Transformer- classification of arc welding process ,shielded Metal Arc welding, Submerged arc welding, Inert gas, Shielded arc welding. TIG, MIG, Welding Electrode coated, bare, function of these coating materials. 06-4 Prepare appropriate joint to perform different weld	06 ding operation	10 n
4 Seme	Other Welding Processes Resistance Welding-Principle – Fundamentals of processes- types of processes. Thermit welding process, Cold welding processes, Electron beam welding, Electro-slag welding, Explosion welding. Friction welding. Laser welding. ster end exam question paper should be such that to	06 Dtal marks of	10
each t	topic is one and half times the marks allotted abo o attempt questions of the above allotted marks only	ve but the c	andidates are

Section II

Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks
MTF406-5 Handle different welding equipments and accessories carefully			
5	Metal transformation in welding Various types of weld joints, Structure of weld joints, Heat affected zone, Pre & post Heat Treatment of welding. Application of various welding process.	06	10
MTF	406-1 Appraise the effects of welding on microstruc	ture of metals	and alloys.
6	Soldering & Brazing Difference between soldering & brazing, characteristics, soft solders, Requirement of soldering alloys, Flux - Types of fluxes and their functions, solder material composition etc.	06	10
MTF	406-7 Use appropriate test to find out soundness	of weld	
7	Testing & inspection of weld Welding defect, their cause & remedies, Inspection of defects, Testing of welds, destructive & Non destructive etc.	04	08
MTF	406-8 select proper modern machining and forming	processes.	
8	Modern Machining Process Characteristics: Electrochemical Machining, Description applications, Electro discharge Machining Description, Process Characteristics, Advantages	04	06
9	Modern Forming Process Modern Forging Process, types of Processes, Powder Forging, Description-Process Characteristics, advantages & Disadvantages. Cold Forging, Description, Characteristic of process, advantages & disadvantages etc.	04	06
C	Total	48	80
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.			

Sr.	Topics	Knowledge	Cognitive Level		Total
no		level	Comprehension	Application	
1	Introduction	02	02		04
2	Gas Welding	04	04	08	16
3	Arc Welding	04	02	04	10
4	Other Welding Process	04	02	04	10
5	Metal Transformation In Welding	02	04	04	10
6	Soldering & Brazing	04	04	02	10
7	Testing & Inspection Of welds	02	02	04	08
7	Modern Machining Process	02	02	02	06
8	Modern forming Process	02	02	02	06

Specification Table:

Laboratory experiences and related skills developed.

Sr no	Laboratory experience	Skills developed
1	Welding of steel component by Oxy-Acetylene gas welding process	 To familiarize with the equipments used in the oxyacetylene gas welding. To familiarize with the arc welding process in the oxy acetylene gas welding. To understand the safety precautions to be taken during the welding process. 4)
2	Electric Arc welding process	 5) To familiarize with the equipments used in the electric arc welding. 6) To familiarize with the arc welding process in the electric arc welding process. 7) To understand the defects produced during the welding process.
3	Spot Welding Process	 7) To familiarize with the equipments used in the spot welding. 8) To familiarize with the arc welding process in the spot welding process. 9) To understand the defects produced during the welding process.
4	Structure of welding	 To understand the effect of welding on the structure of the alloy. To observe the heat affected zone produced during welding.
5	Brazing & Soldering of alloys.	 To familiarize with the equipments used in the brazing & soldering of alloys. To understand the technique of doing brazing & soldering.

Sr no	Laboratory experience	Skills developed
		3) To understand the difference between brazing & soldering.
6	Study of Electrochemical Machining.	 To understand the principle ,construction & working of the electrochemical machining To know the application of electrochemical machine.

Instructional Strategy:

Sr.no.	Topics	Instructional strategy
1	Introduction	Lecture Methods
2	Gas welding	Lecture Method, Practical, Industrial Visit
3	Arc welding	Lecture Methods, Practical.
4	Other welding process	Lecture Method, Transparencies-OHP
5	Metal transformation in welding	Class room Teaching, Practical etc.
6	Soldering & brazing	Lecture method
7	Testing & inspection of welds	Lecture Methods, Practical
8	Modern machining process	Lecture Methods, Demonstration
9	Modern forming process	Lecture Methods, Demonstration

Text Books:

Author	Title	Publisher	
P. N. Rao			
	Modern Manufacturing Process	Tata McGraw Hill Pvt Ltd N.Delhi	
Richard L.	Welding Technology	Tata McGraw Hill Pvt Ltd	
Little			

Reference Books:

Author	Title	Publisher
Nil	Welding Hand book Vol. 2	ASM Handbook
Suresh Daleja	Manufacturing Science &	The McGraw Hill Co. Ltd. N.
	Technology	Delhi
B. Kumar	Manufacturing Technology	Khanna Publisher, N.Delhi
Little	Welding Technology	
P. N. Rao	Modern Manufacturing Process	
COURSE ID:

Course Name Course Code Course Abbreviation : In-plant Training : MTF 407 : EPIT

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits	
Theory		26	
Term work/Practical	416	26	

Evaluation Scheme:

	Progressive	Assessment	Seme	ster end
Component	Theory	Term work**	Theory	Oral**
Duration	Two tests (1hour each)	One practical (2hours)	One paper (3 hours)	
Marks		200		100

*Assessment as per proforma IV: includes the marks of Continuous assessment (TW), Progressive skill test and term end oral/practical.

Course Aim:

The requirement of industry to avail ready to use supervisors in the industry is growing. There is dissatisfaction among the employer industries about the level of knowledge and skills in the pass out diploma students.

There is no better way than getting exposure of direct industrial environment and practices to the students for sufficient period of time to get trained. 'Seeing is believing' is the best way to prepare the students for undertaking assignments in the industries. Classroom teaching is not enough for imparting any skills to the students. It is the apprenticeship which will bridge the gap between the learning in the institution and then applying it in the industry.

Course Outcomes:

- 1. Apply theoreticaldomain knowledge in the industry to produce better products.
- 2. Communicate fluentlyin technical matters.
- 3. Lead team of workers to complete the assigned work

- 4. Report the details of production /quality control/any other essential technical matters to the higher authorities daily or as per the requirement.
- 5. Maintain punctuality in attendance
- 6. Working extensively for 8 hours/day and taking physical exertion.
- 7. Operate machines by following standard operating procedures.
- 8. Care for own and others safety.
- 9. Self Learning by observation, interaction and reading SOP's or manuals.
- 10. Analyze the problems and use discretion to sole them
- 11. Undertake mini outcome based projects on own responsibility.
- 12. Follow protocols, mannerisms, proper body language and good conduct to earn good name for self and the institute.

Course Contents:

Laboratory Work:

As per the topic selected by student.

Specification Table:

Sr.	Торіс	Knowledge	Cogniti	ve Levels	Total
No.			Compre.	Appln.	
1	Inplant training	-	100	100	200

Instructional Strategy:

Hands on training in actual industrial environment.

Reference Books: As per the selected topic for the project.

Learning Resources: Relevant books and experiments.

Skills to Be Acquired By Technician:

Various skills are developed depending on the selected topic. These skills are as follows.

Reading skill, tapping resources including library, using knowledge already acquired, thinking and communication skills, working in groups – leadership. Interactions with industries, developing contacts, meeting people, making survey, cost consciousness, using resources available in other institutes or industries, skill of handling equipment and instruments safety, observing operations critically, skill of recording results and interpretation of results with group discussion, finding solution for problems and quality awareness, presentation of report in writing, participation in exhibition and developing personality and self confidence.

COURSE ID:

Course Name Course Code

:Corrosion and Prevention methods :MTF 410

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Credits	TotalCredits	
Theory	03	05	
Pract/ Tutorial	02	05	

Evaluation Scheme :

Mode of	Progressive Asses	sment	Term	End	Total
Evaluation	Theory	Practical	Theory	Term	
L'uluulon	Theory	Tractical	Theory	Work	
		One mid-	Term Fnd		
Details of	Average of two tests of 20 marks each	term Skill	Theory	As per	
Evaluation		Test (2	Exam	Proform a-III	
		hrs)		u 111	
			(04hours)		
Marks	20	00	80	25*	125

Rationale:

To enable the Metallurgy engineer to take up the supervisory role in various foundry practices such as ferrous and non-ferrous alloys, which are popularly, cast .He should also understand the other supporting activities for foundry and quality assurance.

COMPETENCY:

Knowledge of basic foundry practices.

Cognitive: Familiarize with the corrosion phenomena, its types and preventive measures

Psychomotor: i) Types of corrosion ii) Causes and iii) Preventive techniques

Affective: Attitude of i) Finding and ii) rectifying corrosion

COURSE OUTCOMES:

MTF 410-1 Understand importance of corrosion and Thermodynamic aspects of it MTF 410-2 Gain insights of various forms of corrosion MTF 410-3 Learn mechanical, metallurgical and environmental aspects MTF 410-4 Learn protective methods from corrosion MTF 410-5 Understand and use corrosion testing methods

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

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

					• 110	coi i cia							
				Prog	gramme	e Outco	mes PC) s and]	PSOs				
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iments and practi ce	PO 4 Engin eering Tools	PO 5 The engine er and societ y	PO 6 Envir onme nt and sustai nabilit y	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metall urgist	PSO2 Safety and cleanli ness	PSO3 Recycl ing
Competency: Knowledge of basic foundry practices.	3	3	3	2	2	3	2	2	3	3	3	2	3
MTF 410-1	3	3	2	2	2	2	2	2	2	2	3	3	2
MTF 410-2	3	3	2	3	2	3	2	2	2	2	2	3	3
MTF 410-3	3	3	2	3	2	2	2	2	2	2	2	3	3
MTF 410-4	3	3	2	2	3	2	2	2	2	2	2	2	2
MTF 410-5	3	3	2	2	2	2	2	2	2	2	3	3	2

Course Content:

Section I

Sr. no	Topics/ Subtopics	Lecturers (Hours)	Theory Evaluation (Marks)
Cours	se Outcome MTF 410-1 Understand importance of corrosides of it	on and Therr	nodynamic
1.	Introduction Importance of corrosion, Thermodynamics and Kinetics of Electrode Processes, Free energy concept, Pourbiax Diagram for Metal Water System, Applications and Limitations, Nernst's Equation, Emf Series, Galvanic Series, anodic and cathodic reactions, electrochemical cell analogy, Concept of Over-Potential, Polarization Curves, Evan's Corrosion Diagram, mixed potential theory, Kinetics Of Passivity and Transpassivity.	12	20
Cours	se Outcome MTF 410-2- Gain insights of various forms of co	orrosion	
2.	Forms of corrosion Various Forms of Corrosion Such as Uniform Corrosion, Galvanic Corrosion, Crevice Corrosion, Pitting Corrosion, filliform corrosion, Intergranular Corrosion, Selective Leaching, Erosion Corrosion, Stress corrosion cracking (SCC), Environmental assisted cracking (EAC), fretting damage, Hydrogen Damage, corrosion fatigue, hydrogen embrittlement and microbes induced corrosion.	12	20

	Section II		
Sr. no.	Topics Subtopics	Teaching (Hours)	Theory evaluation Marks

So cti π

3	Material selection	08	10
	Mechanical, Metallurgical and Environmental Aspects.		
	Material Selection for Specific Corrosion Applications		
	Such as Marine Industry, Petrochemical Industry, High		
	Temperature Service, Chemical Industry and Selection		
	of Suitable Design for Corrosion Control		
Course C	Dutcome MTF 410-4 Learn protective methods from corrosion	1	
4	Corrosion protection techniques	08	15
	Principles of Protection, Materials selection,		
	Modification/ Alteration of environment, Design		
	Inhibition, Cathodic protection, Anodic protection,		
	Coating Application Methods for Corrosion Control.		
Course (Outcome MTF 410-5 Understand and use corrosion testir	ng methods	
5	Corrosion testing	08	15
	Corrosion Testing by Physical and Electrochemical		
	Methods. Use of ASTM standards like G- 8, G-5, G-1,		
	A262 etc. NACE standards / their equivalents, Surface		
	Preparation, Exposure Technique salt spray, cyclic		
	corrosion test, weatherometer, immersion test,		
	Corrosion Rate Measurements. Few case studies.		
Semester	r end exam question paper should be such that total ma	rks of anesti	ons on eac
onic is	one and half times the marks allotted above but the	candidates	are able
CLIC ID	the main man the set of marks another above but the	cananatos	are uple

Specification Table for setting question paper for semester end theory paper

Sr	Торіс	Dis	tribution of N	/Iarks	Course	Total
no		Remember	Understan	Applicatio	Outcome	Marks
			d	n		
1	Introduction	10	05	05	MTF 410-	20
					1	
2	Forms of corrosion	10	05	05	MTF 410-	20
					2	
3	Material selection	00	05	10	MTF 410-	15
					3	
4	Corrosion protection	05	05	10	MTF 410-	20
	techniques				4	
5	Corrosion testing	00	00	05	MTF 410-	05
					5	
	Total	45	20	15		80

Text-Books:

Author	Title	Publisher	
M.G. Fontana	Corrosion Engineering	McGraw Hill Publishing	
		Comp.	

Reference Books:

Author	Title	Publisher
-	Metal hand book no-5	American Soc. Of Metals

Instructional Strategy:

Sr.	Topics	Instructional Strategy
No	-	
1	Introduction	Lecture Method
2	Forms of corrosion	Lecture Method
3	Material selection	Lecture method
4.	Corrosion protection techniques	Lecture method industrial visit
5	Corrosion testing	Lecture methods, industrial visit

COURSE ID:

Course Name	: NON- CONVENTIONAL ENERGY SOURCES
Course Code	: MTF 408
Course Abbreviation	: ENCE

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	05

Evaluation Scheme:

Modo of	Progressive Assessment		Term End Examination			
Fuel votion	Theory	Drastical	Theory	Torm Work	Oral	Total
Evaluation	Theory	Practical	Examination	Term work	Examination	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks foreach practicalii) One PST of25 marks	Term End Theory Exam (03 hours)	As per Proforma- III	-	
Marks	20		80	25		125

RATIONALE:

Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population and enhanced standard of living and life style of people. The conventional sources of energy are insufficient to meet these demands. Hence, alternative energy sources are utilized for power production. The use of alternate energy sources is increasing day by day. Diploma engineers are expected to develop, operate and maintain these systems. It is therefore essential to know basics of energy conversion, conservation, and energy audit and waste heat recovery techniques.

Objectives:

Students should be able to,

- 1. Develop awareness for effective utilization of alternative energy sources.
- 2. Identify different components of solar energy and wind energy devices.
- 3. Identify and analyze biomass plant.
- 4. Identify and apply energy conservation techniques for commonly used power absorbing and generating devices.
- 5. Apply principles of energy conservation and energy management techniques.

COMPETENCY: Familiar with conventional and non conventional energy resources

Cognitive : Understand and Use of the various forms of energy resources

Psychomotor : Use the instrument properly.

Affective : Attitude of i) precision ii) accuracy iii) punctuality iv) Ecofriendly Behavior v) sustainable thinking

COURSE OUTCOMES:

MTF-408 -1 Effective utilization of solar energy Appliances .

MTF-408 -2- Identify different parts of wind mill and it's working

MTF-408 -3Identify and analyze different types of biomass plant

MTF-408 -4-Drow the cycle of OTEC. And apply principals for different power plants.

MTF-408-5-Apply energy conservation techniques for commonly used power absorbing and generating devices

MTF-408-6 - Apply principles of energy conservation and energy management techniques

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

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

				Prog	ramme	Outco	mes PC)s and]	PSOs				
Competency and COs	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 The engine er and societ y	PO 6 Envir onme nt and sustai nabilit y	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metall urgist	PSO2 Safety and cleanli ness	PSO3 Recyc ling
Competency:. Applying knowledge of conventional and Non conventional energy resources	3	3	2	3	2	3	2	2	3	3	2	2	2
MTF-408-1	2	3	2	3	2	3	2	2	2	3	3	2	2
MTF 408-2	2	3	2	3	2	3	2	2	2	3	2	2	3
MTF 408-3	2	3	3	2	2	3	2	2	2	3	-	2	3
MTF 408-4	2	3	2	2	3	3	2	2	2	3	2	2	3
MTF 408-5	2	3	2	2	3	3	2	2	2	3	2	2	3
MTF 408-6	2	3	2	2	3	3	2	2	2	3	2	2	-

CONTENT:

A. THEORY:

SECTION-I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	<i>Course outcomeMTF-408 -1 Effective utilization of solar energy Appliances</i>		
1	 SOLAR ENERGY Major Sources of Energy: Renewable and Nonrenewable. Need and Prospectus of Alternate Energy Sources 	08	20
2	 WIND ENERGY 2.1 Principle of Wind energy conversion, Nature of the Wind energy. 2.2 Power in wind, Power coefficient, Maximum power, Wind Energy Conversion 2.3 Selection of site for wind mill. 2.4 Classification of WEC systems. 2.5 Advantages and limitations of WECS 2.6 Basic components of WECS. 2.7 Wind energy collectors- Horizontal and Vertical axis machines, 2.8 Safety systems and Environmental aspects. 	08	12

	<i>Course outcomeMTF-408 -31dentify and analyze different</i> <i>types of biomass plant</i>		
3	 BIO-MASS ENERGY 3.1 Biomass conversion technologies - 1) combustion 2) Thermo chemical 3) Biochemical Wet processes, Dry processes. 3.2 Biogas generation – anaerobic digestion, 3.3 Types of Bio-gas plants, KVIC Digester, Deenbhandu, Pragati Biogas plant. 3.4 Materials used for biogas generation. Selection of site for biogas plant. Applications. 	08	08
	SECTION – II		
Cour plant	rse outcomeMTF-408 -4 -Drow the cycle of OTEC. and apply p	rinciples for d	ifferent power
4	 ENERGY FROM THE OCEANS 4.1 Ocean Thermal Electric Conversion-Methods of Power Generation, Open and closed cycle OTEC system 4.2 Tidal power –Basic Principle, Components of Tidal Power Plants, 4.3 Operation Methods-single basin and double basin 4.4 Advantages and limitations for tidal power Generation 4.5 Sites Requirements. 	08	08
	<i>course outcomeMTE-311-5-</i> Apply energy conservation techniques for commonly used power absorbing and generating devices		

5.1 Geothermal Energy –Sources, Principle, Geothermal energy power plant, Advantages , Limitation & application of Geothermal Energy. 5.2 Small Hydroelectric Plant(Mini and Micro hydel): Nature, Classification of SHP station, Components of SHP, Advantages and Limitation of SHP 5.3 Fuel Cell- Principle of Operation, Classification, Advantages, Limitation and Application of Fuel cell 5.4 Magneto-Hydro Dynamic(MHD) Power Generation- Principles, MHD system, Advantages, Future Prospects course outcomeMTF-408-6 Apply principles of energy conservation and energy management techniques 08 16 6 ENERGY CONSERVATION AND MANAGEMENT 6.1 Energy scenario in various sectors and Indian Economy. 08 16 6.3 Concept of payback period, Return on Investment (ROI),Life cycle cost, Sankey diagrams, Specific Energy consumption 6.4 Principle and methods of energy conservation 6.5 Energy Audit and its types. 6.6 Co-generation and its Application 6.7 Waste Heat Utilization 6.8 Concept and Technique of energy management	5	OTHER ALTERNATE SOURCES OF ENERGY	08	16
Geothermal energy power plant, Advantages , Limitation & application of Geothermal Energy. 5.2 Small Hydroelectric Plant(Mini and Micro hydel): Nature, Classification of SHPstation, Components of SHP, Advantages and Limitation of SHP 5.3 Fuel Cell- Principle of Operation, Classification, Advantages, Limitation and Application of Fuel cell 5.4 Magneto-Hydro Dynamic(MHD) Power Generation- Principles, MHD system, Advantages, Future Prospects course outcomeMTF-408-6 Apply principles of energy conservation and energy management techniques 6 ENERGY CONSERVATION AND MANAGEMENT 6.1 Energy scenario in various sectors and Indian Economy. 08 16 6.1 Energy scenario in various sectors and Indian Economy. 6.2 Need and importance of energy conservation and management. 08 16 6.3 Concept of payback period, Return on Investment (ROI),Life cycle cost, Sankey diagrams, Specific Energy consumption 6.4 Principle and methods of energy conservation 6.5 Energy Audit and its types. 6.6 Co-generation and its Application 6.7 Waste Heat Utilization 6.8 Concept and Technique of energy management		5.1 Geothermal Energy –Sources, Principle,		
Limitation & application of Geothermal Energy. 5.2 Small Hydroelectric Plant(Mini and Micro hydel): Nature, Classification of SHPstation, Components of SHP, Advantages and Limitation of SHP 5.3 Fuel Cell- Principle of Operation, Classification, Advantages, Limitation and Application of Fuel cell 5.4 Magneto-Hydro Dynamic(MHD) Power Generation- Principles, MHD system, Advantages, Future Prospects course outcomeMTF-408-6 Apply principles of energy conservation and energy management techniques 6 ENERGY CONSERVATION AND MANAGEMENT 6.1 Energy scenario in various sectors and Indian Economy. 08 16 6.1 Scocept of payback period, Return on Investment (ROI),Life cycle cost, Sankey diagrams, Specific Energy consupption 08 16 6.3 Concept of payback period, Return on Investment (ROI),Life cycle cost, Sankey diagrams, Specific Energy consumption 6.4 Principle and methods of energy conservation 6.5 Energy Audit and its types. 6.6 Co-generation and its Application 6.7 Waste Heat Utilization 6.8 Concept and Technique of energy management 6.8 Concept and Technique of energy management 6.8 Concept and Technique of energy management		Geothermal energy power plant, Advantages,		
5.2 Small Hydroelectric Plant(Mini and Micro hydel): Nature, Classification of SHPstation, Components of SHP, Advantages and Limitation of SHP 5.3 Fuel Cell- Principle of Operation, Classification, Advantages, Limitation and Application of Fuel cell 5.4 Magneto-Hydro Dynamic(MHD) Power Generation- Principles, MHD system, Advantages, Future Prospects course outcomeMTF-408-6 Apply principles of energy conservation and energy management techniques 6 ENERGY CONSERVATION AND MANAGEMENT 6.1 Energy scenario in various sectors and Indian Economy. 08 16 6.3 Concept of payback period, Return on Investment (ROI),Life cycle cost, Sankey diagrams, Specific Energy consumption 6.4 Principle and methods of energy conservation 6.5 Energy Audit and its types. 06 Concept and methods of energy conservation 6.7 Waste Heat Utilization 6.8 Concept and Technique of energy management		Limitation & application of Geothermal Energy.		
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		6.8 Concept and Technique of energy management		
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above allotted marks only	above	allotted marks only		lucsuons of the

		91				
Tonio		Ľ		Total		
No	Name of topic	Vnowladaa	Commencian	Amplication	Course out	Total
INO.	_	Knowledge	Comprehension	Application	come	marks
1	Solar Energy	10	04	06	MTF408-1	20
2	Wind Energy	04	04	04	MTF408-2	12
3	Bio-Mass Energy	04	02	02	MTF408-3	08
4	Energy From the	02	04	02	MTF408-4	08
4	Oceans	02	04	02		08
5	Other Alternate	08	04	04	MTF408-5	16
5	Sources of Energy	08	04	04		10
6	Energy Conservation	04	04	08	MTF408-6	16
0	and Management	04	04	08		10
	Total >>	32	22	26		80

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

B.TERM WORK

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work in practical sessions of batches of about 22 students:

Sr	Title of Practical Exercise	Skills / Competencies to be	Course outcome
No.		developed	
1)	Study and Demonstration on solar flat plate	1.	MTF408-1
	collector used for water heating.	1.Use and working of Solar flat	
		plate collector.	
2)	Study and Domonstration of working of	1. Use and working of Photo	MTF408-1
	study and Demonstration of working of	voltaic cell.	
	photo voltale cen.	2. operate photo voltaic cell	
3)		1.Identify the parts of solar	MTF408-1
	Demonstration on working of solar cooker.	cooker	
		2. Operate the solar cooker.	
4)		Awareness to hydel power	MTF408-4
	Visit to Mini and Micro hydel power plant.	plant and actual working of	
		hydel power plant	
5)	Visit to solar heating system/ wind power	Awareness of solar heating	MTF408-2
	plant.	system/ wind power plant.	
6)	To study construction and working of	1.Identify the parts of wind	MTF408-2
	horizontal axis wind mill or to visit a	mill	
	nonzontal axis which him of to visit a	2.Use and working of wind	
	hearest which farm.	mill.	
7)	To study construction and working of a	Use and working of biogas	MTF408-3
	biomass/ biogas plant or visit a biomass/	plant	
	biogas plant of municipal waste or		
	elsewhere.		
8)	Case study on Energy Audit.	Suggest the methods of energy	MTF408-6
		saving	

C. INDUSTRIAL EXPOSURE:

SN	Mode of Exposure	Торіс
1.	Industrial Visits	Wind Energy and Biomass Energy
2.	Industrial Visits	Solar heating system

D.ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

i)Continuous Assessment of Practical Assignments :

Every practical assignment shall be assessed for 25 marks.

Sr. No.	Criteria	Marks allotted
1	Correct figures / diagrams	5
2	Observation tables	5
3	Result table / calculations / graphs	5
4	Understanding / workmanship	10
	Total	25

E.INSTRUCTIONAL STRATEGIES:

Instructional Methods:

- 1. Lectures cum Demonstrations
- 2. Classroom practices

Teaching and Learning resources:

- 1. Chalk board
- 2. LCD presentations
- 3. Audio presentations
- 4. Item Bank

F.REFERENCE MATERIAL:

a) Books

Sr. No.	Author	Title	Publisher
1.	DrB.H.Khan	Non-conventional energy	Tata McGraw Hill
		Resources	
2.	G. D. Rai	Non-conventional energy sources	Khanna publication
3.	S. P. Sukhatme	Solar energy	Tata McGraw Hill
4.	H. P. Garg	Solar energy	Tata McGraw Hill
5.	Arora	Power plant engineering	Dhanpat Rai & Co.
6.	Arora and	Power plant engineering	Dhanpat Rai & Co.
	Domkundwar		
7	P.H. Henderson	India- The energy sector	Oxford University Press
8	D. A. Ray	Industrial energy conservation	Pergaman Press
9	W. C. Turner	Energy management handbook	Wiley Press

b) Websites

i)<u>www.mahaurja.com</u> ii) <u>www.indiasolar.com</u>

iii)www.beeindia.in

MPECS 2016 DEPARTMENT OF METALLURGY LEVEL 5

Sr No	Name of Course	Course Code	
	Level 5: Management & Technology Courses		
1	3-D Modeling and Ca	MTF501	
2		Environment protection in metallurgical industries	MTF502
	Elective 2- Group B	Non metallic materials	MTF503
		Characterization of metals	MTF504
		Industrial Management	MTF505
3	Elective 3- Group C	Industrial Engineering	MTF506
		Industrial Organisation and Management.	CCF501

COURSE ID:

Course Name	: 3-D Modelling& Casting Simulation
Course Code	: MTF 501
Course Abbreviation	: EMCS

TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Hours / week	Credit s	
Theory		06	
Practical	06	00	

Evaluation Scheme:

Component	Progressiv	e Assessment	Semester end		
	Theory	Term work	Theory	Practical	
Duration	Duration Two tests (1hour each)		One paper (3 hours)		
Marks		100		50	

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 means solid model is usually originated on the computer by engineer 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 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.

COMPETENCY :

Use modelling software to understand representation of any 2 & 3 dimensional object and to visualize the machine components, assembly in software. To visualize the Part modeling and geometry analysis, Core print design, Mold cavity layout, Feeder & gating design and solidification simulation. To understand casting defects with the help of simulation and remedial solution.

Cognitive: i) Understanding and applying modelling software in engineering field **ii)** Understanding behavior of metals at different temperatures &Visualization of parts in mold.

Psychomotor: i) Use of toolbars 2) Draw 2D sketch 3) Cerate solid model 4) generate assembly 5)create orthographic projection

Affective: Attitude of i) Precision ii) Accuracy iii) Analytical Mind iv) Visualization v) analytical mind.

COURSE OUTCOMES:-

- MTF 501-1 Draw 3D Solid model using toolbar.
- MTF 501-2 Create assembly using details.
- MTF 501-3 Apply dimensions, tolerances and generate tolerances.
- MTF 501-4 Apply conventional representation
- MTF 501-5 Use and apply 3D Solid model input format
- MTF 501-6 Analyze part thickness of Analysis temperature profile
- MTF 501-7 Apply Methods Layout
- MTF 501-8 Apply use cavity layouts &Know Feeder design and solidification simulation
- MTF 501-9 Apply cost on design layout

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

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

		no		Pr	ogrami	ne Out	comes l	POs an	d PSOs		DCOA	DCCC	DCCC
Competency and COs	PO 1 Basi c kno wled	PO 2 Dis cipl ine kno	PO 3 Exper iment s and practi	PO 4 Engin eering Tools	PO 5 The engine er and societ	PO 6 Envir onme nt and sustai nabilit	PO 7 Ethics	PO 8 Indivi dual and team work:	Com m unicat	PO 10 Life- long learni ng	Role of Metall urgist	PSO2 Safety and cleanli ness	Recycl ing
	ge	wle dge	ee		3	у			1011				
Use modelling software to understand representation of any 2 & 3 dimensional object and to visualize the machine components, assembly in software. To visualize the Part modeling and geometry analysis, Core print design, Mold cavity layout, Feeder & gating design and solidification simulation. To understand casting defects with the help of simulation and remedial solution	2	2	2	3	1	2	1	2	2	3	2	1	1
MTF501-1 Draw 3D Solid model using toolbar.	2	2	1	1	-	1	1	1	1	1	1	1	1
MTF501-2 Create assembly using details.	1	2	3	2	-	1	2	2	2	3	1	1	
MTF501-3Apply dimensions,tolerances and generate tolerances.	1	1	2	3	1	1	2	2	1	2	1		
MTF501-4Apply conventional representation	3	2	3	2	2	2	2	3	3	3	1		
MTF501-5Use and apply 3D Solid model input format	2	2	3	3	2	2	2	2	2	3	1		
MTF501-6Analyze part thickness of Analysis temperature profile	2	2	3	3	2	1	2	3	3	3	1		
MTF501-7Apply Methods Layout	1	2	2	2	1	2	2	2	2	2	1		
MTF501-8Apply use cavity layouts &Know Feeder design and solidification simulation	2	2	3	2	2	2	1	2	2	2	1		
MTF501-9Apply cost on design layout	2	2	2	2	3	2	2	2	2	2	1		

SECTION I :-

Sr. no	Topics Subtopics	Teachin g (Hours)	Practical Marks				
Course	Course Outcome MTF501-1 Draw 3D Solid model using toolbar.						
1	Auxiliary Views: Study of auxiliary planes, Projection of objects on auxiliary planes. Completing the regular views with the help of given auxiliary views (Use first angle method of projection)	04	10				
Course	e Outcome MTF501-2 Create assembly using details.						
2	 Intersection of Solids: Curves of intersection of the surfaces of the solids in the following cases: 2.1 Prism with prism, Cylinder with cylinder, Prism with Cylinder When (i) the axes are at 90° and intersecting (ii) The axes are at 90° and Offset 2.2 Cylinder with Cone When axis of cylinder is parallel to both the reference planes and cone resting on base on HP and with axis intersecting and offset from axis of cylinder 	08	14				
Course	e Outcome MTF501-3 Apply dimensions, tolerances and generate tolera	nces					
3	 Conventional Representation: 3.1. Standard convention using SP – 46 (1988) 3.2 Materials- C.I., M.S, Brass, Bronze, Aluminium, wood, Glass, Concrete and Rubber 3.3 Long and short break in pipe, rod and shaft. 3.4 Ball and Roller bearing, pipe joints, cocks, valves, internal / externalthreads. 3.5 Various sections- Half, removed, revolved, offset, partial and aligned sections. 3.6 Knurling, serrated shafts, splined shafts, keys & key ways 3.7 Springs with square and flat ends, Gears, sprocket wheel, chain wheels 3.8Countersunk & counter bored holes. 3.9 Tapers 	08	12				
Course	e Outcome MTF501-4Apply conventional representation						

	Production Drawings		
4	 4.1Limits,fits and tolerances: Definitions, Introduction to ISO system of tolerencing- unilateral and bilateral and its representation on drawing, dimensional tolerances elements of interchangeable system, hole & shaft base systems, tolerance diagram, Selection of fit (clearance, transition and interference) for engineering applications. 4.2 Geometrical tolerances: Definitions, Tolerances of form and position and its geometric representation-tolerance frame, datum feature, magnitude of tolerance and symbol, interpretation of a given symbol on drawing, simple examples. 4.3 General welding symbols: Symbolic representation in Engineering practices and its interpretation. 4.4 Characteristics of surface roughness: Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods, using ISO code. Relation of surface roughness values with mfg processes. 	08	12
	Total	40	48

SECTION II:-

Sr. no	Topics Subtopics	Teachin g (Hours)	Practical Marks	
Cours	e Outcome MTF501-5 Use and apply 3D Solid model input format			
5	Part modelling 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.	12	08	
Cours	e Outcome MTF501-6 Analyze part thickness of Analysis temperature pr	ofile		
6	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	16	10	
Course Outcome MTF501-7 Apply Methods Layout				
7	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	12	
Cours	e Outcome MTF501-8 Apply use cavity layouts &Know Feeder design a	nd solidifica	tion simulation	
8	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.	12	10	
Course	e Outcome MTF501-9 Apply cost on design layout			
9	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.	08	08	
	Total	40	48	

Does not require Specification Table

B) TERM WORK shall consist of the following

Sr. No.	Title of Assignment	Skills to be developed	Course Outcome
1	Creation of minimum 4 different 2 D sketches	Use toolbars, understand degree of freedom	MTF501-1
2	Creation of at least 5 solid models using solid modeling features.	Create solid models & Know command dialogue box.	MTF501-2
3	Creation of 2 assembly drawings each of at least 5 components.	Generate and analyse assembly.	MTF501-3
4	Generation of orthographic projections front view, top view, side view, isometric view.	use orthographic projections.	MTF501-3 MTF501-4
5	Creation of Production Drawings	Know command dialogue box.	MTF501-5
6	Part modelling and geometry analysis	Use toolbars and to educate them with basic software systems.	MTF501-5
7	Feeder design,Gating design and mold filling simulation	Use correct combination of mold box to design, model and verify the gating channel design.	MTF5016 MTF501-7 MTF501-8
8	Casting cost estimation	to estimate the cost of a casting	MTF501-9

Laboratory	Ex	periments	and	related	skills to	be	develo	ned.
Laboratory		perments	anu	Terateu	skins to	υc	uc veio	peu.

Note: 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

Guideline for Practical: One student per computer terminal.

Note: Use of any one Solid Modeling & casting simulation Software of Latest Version is recommended.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher / Edition
1	Sham Tickoo	CATIA V5R17 for Designers	Softcover, Cadcim Technologies

Curriculum MPECS-2016 Diploma in Metallurgical Engineering (Foundry)

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	

CDs, PPTs Etc.:

- 1. Tutorials Catia V5 by CADENV website: www.cadnev.com
- 2. Pro/ENGINEER Multimedia Trainer DVD from CADCIM
 - a. website: www.cadciMTFch.com
- 3. Solid Edge Training Videos by Edge Learn Interactive
- 4. NX4 DVD Video Training website: www.traing-classes.com
- 5. SolidWorks 2011 Traing Video by website: www.soloidworkstutorials.com
- 6. Video Bases Autodesk Inventor 2011 Tutorial website: www.softwaretraingtutorials.com

Websites:

- 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/

Equipment List:

- 1. Latest Configuration Computers which can be able to run latest any Solid Modeling Software. (One Computer per student in practical session.)
- 2. Any latest Authorised Solid Modeling Software.
- 3. Plotter of size A2/A3
- 4. LCD Projector

Course Code	Course Name	Course Abbreviation
MTF 502	Environment Protection in Metallurgical Industries	EENP

Pre-requisites: None.

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	3	5
Practical	2	

Evaluation Scheme:

Component	Progressive	e Assessment	Semester end		
I	Theory	Skill Test	Theory	Term work	
Duration	Two tests (1hour each)	One practical (2hours)	One paper (3 hours)		
Marks	20 each	25	80	25	

Assessment for Semester End Practical Exam as per Pro-forma II.

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.

COMPETENCY :

Applying knowledge of polluting substances and its control for environment protection.

Cognitive : Explain the nature, acceptable limits of polluting substances and treatments to avoid its impact on environment.

Psychomotor : Use of instrument to measure noise pollution.

Affective : Attitude of i) precision ii) accuracy iii) punctuality iv) aesthetic presentation

COURSE OUTCOMES :

- MTF 502-1 Apply environment control acts& Industrial Act
- MTF 502-2 Identify nature and sources of air pollutants and recommendations to reduce them.
- MTF 502-3 Understand nature and sources of air pollutants and recommendations to reduce them.
- MTF 502-4 Familiar with sources, effects and prevention of noise pollution.
- MTF 502-5 Understood global pollution due to Green house effect, acid rain, photochemical smog, ozone depletion.
- MTF 502-6 Draw waste water treatment.
- MTF 502-7 Identity hazardous waste and its reclamation
- MTF 502-8 Familiar with and effects of thermal and radiation pollution and its treatment and disposal.
- MTF 502-9 Use environmental impact assessment and auditing.

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

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

				Prog	ramme	Outco	mes P()s and	PSOs				
Competency and COs	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Exper iment s and practi ce	PO 4 Engin eering Tools	PO 5 The engine er and societ y	PO 6 Envir onme nt and sustai nabilit y	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Com munic ation	PO 10 Life- long learni ng	PSO1 Role of Metall urgist	PSO2 Safety and cleanli ness	PSO3 Recyc ling
Competency: Applying knowledge of polluting substances and its control for environment protection.	3	3	2	3	2	3	2	2	3	3	3	2	2
MTF 502-1	3	3	2	3	2	3	2	2	2	2	3	3	2
MTF 502-2	3	3	2	3	2	3	2	2	2	2	2	3	3
MTF 502-3	3	3	3	2	2	3	2	2	2	2	2	3	3
MTF 502-4	3	3	2	2	3	3	2	2	2	2	2	3	3
MTF 502-5	3	3	2	2	3	3	2	2	2	2	2	3	3
MTF 502-6	3	3	2	2	3	3	2	2	2	2	2	3	3
MTF 502-7	3	3	2	2	3	3	2	2	2	2	2	3	3
MTF502-8	3	3	2	2	3	3	2	2	2	2	2	3	3
MTF 502-9	3	3	2	2	3	3	2	2	2	2	2	-	-

Sr. no.	Topics	Teaching	Theory Evaluation
	Subtopics	(Hours)	Marks
	MTF502-1-Apply environment control acts & Industrial Act		I
	Introduction	02	04
1	 1.1. Environment. 1.2. Classification of pollution & pollutants. 1.3. Environment & pollution control Acts. 1.4. Industrial Act & It's Regulation 		
	<i>MTF 502-2</i> Identify nature and sources of air pollutants and recom	nendations to	reduce them.
2	Air Pollution in foundries	08	14
	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.		
	MTF502-3 Understand nature and sources of air pollutants and rec them.	commendation	s to reduce

		0	10
3	Air Pollution In Rolling Mills	8	12
	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.		
	MTF502-4 Identify sources, effects and prevention of noise pollution	1	
4	Noise Pollution7.1Sources & effects of noise pollution.7.2Measurement of noise pollution.7.3Prevention & control of noise pollution.	03	06
	MTF 502-5 Understood global pollution due to Green house effect smog, ozone depletion	t, acid rain, ph	otochemical
5	Global Pollution	03	04
	6.1 Green- house effect.		
	6.2 Acid rain.		
	6.3 Photochemical smog.		
	6.4 Ozone depletion problem.		
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 question	ions of the abo	ve allotted
marks on	у		

Section II

Sr. no.	Topics	Teaching	Theory evaluation
	Subtopics	(Hours)	Marks

	MTF 502-6 Draw the waste water treatment.		
6	Waste Water Treatment Preliminary treatment, Primary treatment, Secondary treatment.	06	12
	Tertiary treatment. Sludge treatment & disposal		
	MTF 502-7 Identify hazardous waste and its reclamation		
7	Hazardous Waste :	10	14
	Defining hazardous waste.Treatment & disposal of hazardous waste.		
	Hazardous 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		
	MTF 502-8 Familiar with sources and effects of thermal and radiation pollution and its treatment and disposal		
8	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 <i>MTF502-9 Use environmental impact assessment and auditing</i> .	04	08
9	Environmental Impact Assessment and Auditing Environmental impact assessment. Environmental audit.	04	06
Semester times the only.	end exam question paper should be such that total marks of questions of marks allotted above but the candidates are able to attempt questions	on each topic i of the above a	s one and half allotted marks

Section / Topic	Name of tonic	Distribution	of marks (Cogn	itive level-wise)	Course	Total
no.	Tunie of topic	Remember	Understand	Application	Outcome	marks
I/1	Introduction	2	2	-	MTF502- 1	04
I/2	Air pollution in fountries	4	8	2	MTF502- 2	14
I/3	Air pollution in Rolling mill	4	4	4	MTF502- 3	12
I/4	Noise pollution	2	4	-	MTF502- 4	06
II/5	Global pollution	2	2	-	MTF502- 5	04
II/6	Waste water treatment	2	8	2	MTF502- 6	12
II/7	Hazardous Waste	4	8	2	MTF502- 7	14
II/8	Thermal pollution and Radiation Pollution	2	4	2	MTF502- 8	08
II/9	Environment impact Assessment and Auditing	02	04	-	MTF502- 9	06
	Total	32	32	16		80

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

Sr.	Laboratory Experience	Skills Developed	Course
No.		-	Outcomes
1	Estimation of suspended particulate matter in	Mgt.Skills, proper	MTF502-1 TO
	air by high volume sampler.	handlingof	MTF502-2
		instument	
2	Analysis of carbon monoxide, carbon dioxide,	Accuracy.	MTF502-2
_	sulfur dioxide by Orsat's analysis.	punctuality	
		r · · · · · · · · · ·	
2			N/TE502.2
3	Measurement of hydrogen sulfide in air by	Mgt. Skills, proper	MTF502-2
	Gas monitor.	handling of	
		instrument	
	Measurement of aerosols by filtration		
1	Determination of turbidity of given effluent	Accuracy	MTF502-2
1	sample	nunctuality	WIII 502-2
	sample.	laboratory work	
		aboratory work	
2	Determination of total solids, total suspended	, proper handling	MTF502-2
	solids, total dissolved solids of given effluent	of instrument	
	sample.		
	-		
3	Determination of dissolved oxygen in given	Accuracy,	MTF502-2
	effluent sample.	punctuality,	
		laboratory work	
4	Determination of biological oxygen demand in	Analytical mind	MTF502-2
•	given effluent sample	Testing quality	WIII 502 2
	Si ven errigene sampre.	resting quanty	
~			N/TE502.2
5	Determination of chemical oxygen demand in	Accuracy,	MTF502-2
	given effluent sample.	punctuality,	
		laboratory work	
6	Determination of acidity/ alkalinity in given	Accuracy,	MTF502-2
	effluent sample	punctuality.	
		laboratory work	
7.	Prepare a visit report of effluent treatment		
	plant at any process industry visited.	Analytical mind	
	ivieasurement of sound by sound level	Anaryucai mind,	
	Nisit the industry & prepare a report on	resung quanty	MTF502-4
	pollution control devices & equipments		
	ponation control de troos de equipments.		
	Visit the pollution control laboratories of state		
	pollution control board/ environ consultants of		
	process industries & prepare a report on		

laboratory testing devices. Prepare an	
environment audit report for any process	
industry.	
Prepare an environment impact assessment report for any organic industry.	

Criteria for Continuous Assessment of Practical Work and Progressive Skill Test:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	5
2	Preparedness for practical	10
3	Correct figures / diagrams	05
4	Result table / calculations / graphs	05
	Total	25

Instructional strategies:

- 1) Lectures and discussions.
- 2) Laboratory experiences and laboratory interactive sessions.
- 3) Time bound assignments.
- 4) Factory Visits.

Teaching and Learning Resources, including References of Books:

- 1) Chalk & Black-Board
- 2) O.H.P.
- 3) Slides
- 4) Video Films.
- 5) Books:
 - 1) Principals of Foundry Technology O. P. KHANA
 - 2) Principals of Foundry Technology P.L.JAIN

Criteria for Assessment for Semester End Practical exam:

Sr. no	Criteria	Marks Allotted
1	Correct figures / diagrams	5
2	Observation tables	5
3	Result table / calculations / graphs	10
4	Safety / use of proper tools / workmanship	5
	Total	25

Assessment for Semester End Practical Exam as per Pro-forma II.
Name of Program

: MTF 503 : Non – Metallic materials

Prerequisite: None

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	3	3+2

Evaluation Scheme:

Component	Progressive Assessment		Semester end	
Ĩ	Theory	Term work	Theory	Oral*
Duration	Two tests (1hour each)	One practical (2hours)	One paper (3 hours)	
Marks	20	25	80	25

*Assessment as per proforma III: includes the marks of Continuous assessment (TW), Progressive skill test and term end oral/practical.

Course Aim:

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 derived 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.

Course Objectives:

- To make the students aware about the various non-metallic materials used in engineering applications.
- To know the basic principles necessary for understanding nature and properties of materials.
- To understand the relation between structure and properties of materials.

COURSE OUTCOMES:

- MTF 503-1 Understand various structures of solids
- MTF 503-2 Introduction to colloids and polymers
- MTF 503-3 Understand importance of rubbers and it's use
- MTF 503-4 Use of various kinds of glasses and their applications
- MTF 503-5 To get to know about ceramics and their basics
- MTF 503-6 Understand the use of adhesives
- MTF 503-7 Use of lubricants, their types and specific use of it
- MTF 503-8 Use of composite materials, their types and specific use of it
- MTF 503-9 Understand types and use of insulating materials
- MTF 503-10 Learning about magnetic materials

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

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

Curriculum MPECS-2016 Diploma in Metallurgical Engineering (Foundry)

	Programme Outcomes POs and PSOs												
Competency and Cos	PO 1 Basic knowl edge	PO 2 Discip line knowl edge	PO 3 Experi ments and practic e	PO 4 Engine ering Tools	PO 5 The engine er and society	PO 6 Enviro nment and sustain ability	PO 7 Ethics	PO 8 Indivi dual and team work:	PO 9 Comm unicati on	PO 10 Life- long learnin g	PSO1 Role of Metall urgist	PSO2 Safety and cleanli ness	PSO3 Recycl ing
Competency: Knowledge of basic foundry practices.	3	3	3	1	2	2	2	2	3	3	3	2	3
MTF 503-1	3	3	2	1	2	2	2	2	2	2	3	3	2
MTF 503-2	3	3	2	1	2	2	2	2	2	2	2	3	3
MTF 503-3	3	3	2	1	2	2	2	2	2	2	2	3	3
MTF 503-4	3	3	2	1	3	2	2	2	2	2	2	2	2
MTF 503-5	3	3	2	1	2	2	2	2	2	2	3	3	2
MTF 503-6	3	3	2	1	3	2	2	2	2	2	2	3	3
MTF 503-7	3	3	1	1	2	1	-	-	1	3	3	2	2
MTF 503-8	3	3	1	1	2	1	-	-	1	3	3	2	2
MTF 503-9	3	3	1	1	2	1	-	-	1	3	3	2	2
MTF 503-10	3	3	1	1	2	1	-	-	1	3	3	2	2

Course Content:

Section I:

C.	Topics/	Lecturers	Theory
Sr.	, r		Evaluation
IIO	Subtopics	(Hours)	(Marks)
Course	e Outcome MTF 503-1 Understand various structures of solids		
1.	Structure of Solids Crystalline nature, types of structures, carbon, silica, silicate, glasses etc.	04	4
Cours	e Outcome MTF 503-2- Introduction to colloids and polymers		
2.	 Colloids and Polymers a) Classification of colloids, intermediate systems, gels and pastes, clay-water dispersions emulsions. b) Polymers : Introduction, polymerization and its mechanisms, formations of polymers, structure, physical properties and chemical resistance. Specific polymeric materials, polyethylenes, resins, foamed plastics, wood, natural resins, PVC, acrylic polymers. 	06	12
3.	Rubbers Occurrence, structure & properties of rubbers. Important applications in engineering industry. Natural rubber, styrene, butadiene, bectyl rubber, nitrite rubber etc. Vulcanization of rubber, forming & fabrication techniques for rubber.	05	8
Course	e Outcome MTF 503-4- Use of various kinds of glasses and their applie	cations	
4	Glasses	05	8
	Structure of glasses, silicate structure, composition, properties,		
	glass production and processing. Important types: Vitreous		

Sr.	Topics/	Lecturers	Theory Evaluation
no	Subtopics	(Hours)	(Marks)
	fused silica-polycrystaline glass, soda lime, lead glass,		
	borosllicate glass, glass ceramics.		
Semes	ter end exam question paper should be such that total marks of questio	ns on each to	opic is one and
half tir	nes the marks allotted above but the candidates are able to attempt que	stions of the	above allotted
marks	only.		

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	-						
Sr.	Topics/	Lecturers	Theory Evaluation				
no	Subtopics	(Hours)	(Marks)				
Course	e Outcome MTF 503-5- To get to know about ceramics and their bas	sics	I				
5.	Ceramics Nature & types of ceramics, general characteristics, common oxides, clays-porcelain – insulating materials, abrasives carbides, enamels, ceramic lubricants, steatites etc.	4	8				
Section	n II:						
Course	e Outcome MTF 503-6- Understand the use of adhesives						
6.	Adhesives Characteristics of adhesives, adhesive bonding, mechanisms and applications of adhesives, types of adhesives, use of adhesives, adhesive joints, advantages and disadvantages of adhesive bonding	05	8				
Course	e Outcome MTF 503-7- Use of lubricants, their types and specific us	se of it					
7.	Lubricants Function and characteristics of lubricating oils, Theory of lubrication, organic liquids, synthetic lubricating oils – cutting fluids – lubricating greases – solid lubricants.	05	8				
Course	Course Outcome MTF 503-8- Use of composite materials, their types and specific use of it						
8	Composite materials Introduction, classification of components, manufacturing processes, FRP composite, protective coating on composites. Concrete, prestressed concrete.	05	8				
Course	e Outcome MTF 503-9- Understand types and use of insulating mate	erials					

9.	Insulating materials Types of insulating materials – properties and requirements of insulating materials thermal, electrical and sound insulating materials.	5	8
Cour	se Outcome MTF 503-10- Learning about magnetic materials		
10.	Magnetic materials	4	8
	Magnetism in solids, magnetic properties, concepts of ferromagnetic, paramagnetic, diamagnetic properties and materials, ferrites, soft magnetic materials and hard magnetic materials.		

Specification Table:

Sr.	Торіс	Cognitive Levels				
110.		Knowledge	Comprehension	Application		
Section I						
1.	Structure Of Solids	03	02		05	
2.	Colloids &Polymers	10	05	05	20	
3.	Rubbers	03	02		05	
4.	Glasses	03		02	05	
5.	Ceramics	03		02	05	
		Section II	[I	
6.	Adhesives	03	03	02	08	
7.	Lubricants	05		03	08	
8.	Composites	05		03	08	
9.	Insulating Materials	05		03	08	
10.	Magnetic Materials	05		03	08	

Text-Books:

Author	Title	Publisher
Zbigniew .D. Jastrzebski	Nature And Properties Of Engg. Materials	Toppan Printing Company, Ltd.Japan.
Lawerence H. Van Vlack	Elements of Material Science	Addison –Wesley Publishing Company, INC, London.

Reference Books:

Author	Title	Publisher
Gupta A.K and Gupta R.C	Material Science	S. Chand and Company Limited.

Learning Resources:

Transparency - O. H. P., Books

COURSE ID:

Course Name	: INDISTRIAL MANAGEMENT
Course Code	: MTF 505
Course Abbreviation	: E FM

TEACHING AND EVALUATION SCHEME :

Pre-requisite Course(s) : Nil

Teaching Scheme :

Scheme component	Hours / week	Credits
Theory	03	
		03
Practical	NIL	

Evaluation Scheme :

	Progressive	Assessment	Semest	Total	
Component	Theory	Practical	Theory	Practical*	
Duration	Average of two tests of 20 marks each	One Skill Test (2 hours) *	One paper (3 hours)	One practical (2 hours)	
Marks	20	NIL	80	-NIL	100

* Assessment as per pro-forma II

I – Internal Examination

RATIONALE :

Management ability is a higher grade ability which every successful Engineer must possess. Management science has been developed to control activities of organization to achieve the objectives of management. It is impossible for an individual though technically sound to control activities of organization. Effective implementation of management policies is tough task. The Diploma holder should know these techniques. After some experience Diploma holder will in position of Manager so he must know Management principles

COMPETENCY :

Cognitive : Understanding Industrial Organisation, Industrial engg. ,Q.M.

Psychomotor : Actual giving results/ out put for achieving objective of Management.

Affective : Attitude of 1) Logic 2) Accuracy 3) Precision 4) punctuality 5) knowledge & hard working.

COURSE OUTCOMES:

MTF 505 -1-to understand over view of business, forms of organization.

MTF505-2-to study functions various of management, as management process.

MTF 505-3-to study materials management as inventory control, ABC analysis, EOQ, material handling, &store, purchase procedure.

MTF 505-4-to study Modern management techniques, CPM, PRET, ERP, Q.M., S.Q.C., Q.A, TQM, 6Sigama ISO9000-2000.

MTF 505-5- to understand HRM, personal management, training, industrial acts, & accidents.

MET 505-6- to understand about financial management, capitals, sourse of capital, tax GST.

MTF 505-7- to understand about plant layout, process planning, plant capacity, machine capacity.

MTF 505-8- to understand Work study, method study, work measurement , job cost working.

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

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

Curriculum MPECS-2016 Diploma in Metallurgical Engineering (Foundry)

	Programme Outcomes POs and PSOs											
Competency and Cos	PO 1 Basic knowled ge	PO 2 Discipli ne knowled ge	PO 3 Experim ents and practice	PO 4 Enginee ring Tools	PO 5 The engineer and society	PO 6 Environ ment and sustaina bility	PO 7 Ethics	PO 8 Individu al and team work:	PO 9 Commu nication	PO 10 Life- long learning	PSO 1Design and Implem entation	PSO 2Provid e solution
Competency: understanding IOM	3	3	-	-	2	-	-	3	1	2	3	3
MET 505-1	3	3	-	-	-	2	-	3	2	3	2	1
MTF 505-2	3	3	2	-	-	-	2	3	2	3	2	2
MTF 505-3	3	3	-	-	2	-	2	3	2	3	3	3
MTF 505-4	3	3	-	-	-	-	-	3	3	3	3	3
MTF 505-5	3	3	2	1	-	-	-	3	3	3	3	3
MTF 505-6	3	3	-	-	3	-	2	3	3	3	2	2
MTF 505-7	3	3	3	-	2	-	2	3	3	3	2	2
MTF 505-8	3	3	3	2	-	-	-	3	1	2	2	2

CONTENT :

A) THEORY :

Section I

Sr. No.	Sr. No. Topics / Sub-topics		Theory Evaluation (Marks)			
Cours	Course Outcome MTF 505-1 to understand over view of business & forms of organization.					
1	BUSINESS, FORMS OF ORGANISATION	06	08			
	1.1 Types of business, forms of organisation					
	1.2 Individual propritorship					

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	 1.3 Partnership organisation 1.4 Joint stock companies 1.5 Co Operative organisatio 1.6 Public sector organisation 1.7 Government Undertaking company 		
2	 MANAGEMENT PROCESS. 2.1 Concept, Importance, Levels of management 2.2 FUNCTIONS OF MANAGEMENT 2.2.1 14 Principles of management by H. Fayol. 2.2.2 Planning:- principles of planning, steps in planning, types of plans. 2.2.3 Decision making:- Procedure ,conditions, basic types of decisions. 2.2.4 Organizing:- concept, types of Org., departmentation , its types, Authority & responsibility, span of control. 2.2.5 Directing:- concept , leadership, its types, motivation, three approaches of motivation theory. 2.2.6 Communication:- Process, impact of MIS, hurdles in effective communication, types. 2.2.7 Controlling:- procedure, methods of control. 	06	10
Cour	se OutcomeMTF505-2 to study various functions of managem	ent as manag	ement process.
3 Cour ERP	MATERIALS MANAGEMENT.3.1 Definition, importance, inventory control.3.2 ABC analysis, EOQ, reordering quantity, & time.3.3 Material handling ,factors selecting system, types ofmaterial handling equipments3.4 purchase & store procedures, recording systems.se OutcomeMTF505-4 to understand modern management tech0, QM, SQC, TQM, 6Sigma, 5"S", ISO9000-2000.	06 hniques as C	08 РМ, РКЕТ,
4	 MODERN MANAGEMENT TECHNIQUES, Q.M. 4.1 PERT & CPM,terms related to net work diagram, net work construction, time estimation (numerical) 4.2 Introduction to ERP, JIT. 4.3 Quality Management:- definition of quality, quality control, quality circle, 4.4 Introduction to T.QM.,6Sigma, 5"S", ISO 9000-2000 standards its structure.,brain stroming, 	14	14

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	4.5 Statistical Quality control (SQC), process control methods, control charts, process capability.		

	SECTION II						
Course	Course out come MTF505-5 to understand HRM, personal management, training, Industrial						
acts, a	ccident cause & remedies.						
5	 HUMAN RESOURSE MANAGEMENT 5.1 Concept, personal management, human recourse ,training, types of training. 5.2 Industrial acts: - Factory act, boiler act, workman compensation act, ESI act, industrial dispute act. 5.3 Accidents: - causes, preventive measures, reporting. 5.4 Safety training. 	06	08				
6	 FINANCIAL MANAGEMENT 6.1 Concept, importance, types of capitals, capital management. 6.2 Source of finance , Internal & external 6.3 Financial institutions 6.4 Tax:- service tax, income tax, GST. 	06	08				
Course Capita	Course Outcome MTF 505-6 to understand about Financial management, Capitals, Source of Capitals, Tax GST						

7	PLANT LAY OUT & PROCESS PLANNING.	06	10			
	7.1. Objective, types of lay outs, design principles of design.7.2 Planning of process from raw material to finish product, factors affecting process planning.					
	7.3 Deciding sequence of operations, operation sheet, combine operation.					
	7.4 Selection of machinery, plant capacity, machine capacity.					
Sr.	Topics /	Lectures	Theory Evaluation			
No.	Subtopics	(Hours)	(Marks)			
Course	Course Outcome MTF505- 7 To understand about plant lay out, process planning, plant capacity, machine capacity.					
capaci	e Outcome MTF505- 7 To understand about plant lay out, proce ty, machine capacity.	ss planning, j	plant			
course capaci	e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity. WORK STUDY.	ss planning, j 14	plant 14			
capacia 8	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 	ss planning, j 14	plant 14			
capaci	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 	ss planning, j 14	plant 14			
capaci.	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 8.3 Work measurement, objective, procedure, Time study , calculation of Standard time. 	ss planning, j	plant 14			
capaci.	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 8.3 Work measurement, objective, procedure, Time study , calculation of Standard time. 8.4 Analytical estimation, use of Std. time for job cost calculation, 	ss planning, j	plant 14			
capaci 8	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 8.3 Work measurement, objective, procedure, Time study , calculation of Standard time. 8.4 Analytical estimation, use of Std. time for job cost calculation, 8.5 Allowances used for std. time calculation. 	ss planning, j	plant 14			
capaci. 8	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 8.3 Work measurement, objective, procedure, Time study , calculation of Standard time. 8.4 Analytical estimation, use of Std. time for job cost calculation, 8.5 Allowances used for std. time calculation. 	ss planning, j	plant 14			
capaci 8	 <i>e Outcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 8.3 Work measurement, objective, procedure, Time study ,calculation of Standard time. 8.4 Analytical estimation, use of Std. time for job cost calculation, 8.5 Allowances used for std. time calculation. 	ss planning, j	plant 14			
capaci. 8	 <i>Poutcome MTF505- 7 To understand about plant lay out, procesty, machine capacity.</i> WORK STUDY. 8.1. Concept, method study, objective & procedure of method study, selection of work. 8.2 Micro motion study, critical examination. 8.3 Work measurement, objective, procedure, Time study ,calculation of Standard time. 8.4 Analytical estimation, use of Std. time for job cost calculation, 8.5 Allowances used for std. time calculation. 	14	plant 14			

	Course out come MTF505-8 To understand Work study, method study, work measurement,			
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	Name of topic	Distribution	of marks (Cogr	Course Outcome	Total	
no.		Remember	Understand	Application		marks
I/1	Forms of of organisation	4	2	2	MTF505-1	08
I/2	Management process	2	2	6	MTF505-2	10
I/3	Materials management	4	2	2	MTF505-3	08
I/4	Modern management techniques, QM	4	4	6	MTF505-4	14
II/5	Human resource management	2	2	4	MTF505-5	08
II/6	Financial management	2	2	4	MTF505-6	08
II/7	Plant lay out process planning	2	4	2	MTF505-7	10
II/8	Work study	4	4	6	MTF505-8	14

Total	22	22	36	80

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.

B) TERM WORK Term work shall consist of the following :

Laboratory experiments and related skills to be developed : NOT APPLICABLE.

C) INDUSTRIAL EXPOSURE

Sr.	Mode of Exposure	Торіс
No.	(Visit/Exp.Lect/Ind.Survey/)	
1.	Field applications in theory lectures in every topic	All topics in course syllabus
	• •	

Instructional Methods :

1. Lectures cum Discussions 2. Regular Home Assignments. 3. Laboratory work

Teaching and Learning resources:

1. Chalk board 2. Video clips 3. Slides 5. Charts

REFERENCE MATERIAL :

a) Books / Codes

Sr.	Author	Title	Publisher
No.			
1.	P.C.Pandey &	Management science	Dhanpat Rai & sons
	C,K, Sing		New Delhi
2.	Banga Sharma	Industrial Engg.& Management system	Tata Mc Graw Hill
3	P.T.ghan	Industrial Organisation	Tata Mc Graw Hill
4	R.C.Gupta	S.Q.C.	Tata Mc Graw Hill
5	O.P.khanna	Industrial Engineering & Management	Dhanapat Rai & sons .
6	ILO	Work Study	ILO Geneva

b) Websites

- i)
- http://www.physicsclassroom.com http://scienceworld.wolfram.com/physics/ ii)
- http://physics.about.com/ iii)

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