

SCHEME OF COURSE WORK (R-2020)

Course Details:

Course Title	Materials Science and Engineering	L T P C	2 0 0 2
Course Code	22ME1101		
Program	B. Tech		
Specialization	Mechanical Engineering		
Semester	II		

Course Outcomes (COs): At the end of the course a student will be able to

CO	Course Outcomes
CO1	explain binary phase diagrams
CO2	apply heat treatment to different applications
CO3	select steels and cast irons for a given application.
CO4	select nonferrous metals and alloys in engineering.
CO5	choose composites for various applications and assess the properties of nano-scale materials and their applications.

Program Outcomes (POs): A graduate of mechanical engineering will be able to

PO 1	Apply the knowledge of mathematics, science, engineering fundamentals to solve complex mechanical engineering problems
PO 2	Identify, formulate and analyze problems related to mechanical engineering
PO 3	Design solutions for mechanical system components and processes that meet the specified needs with appropriate consideration for public health and safety
PO 4	Perform analysis, conduct experiments and interpret data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions
PO 5	Select and apply appropriate techniques from the available resources and current mechanical engineering and software tools
PO 6	Carry out their professional practice in mechanical engineering by appropriately considering and weighing the issues related to society
PO 7	Understand the impact of the professional engineering solutions on environmental safety and legal issues
PO 8	Transform into responsible citizens by resorting to professional ethics and norms of the engineering practice
PO 9	Function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams
PO 10	Communicate fluently with the engineering community and society, and will be able to prepare reports and make presentations effectively
PO 11	Apply knowledge of the engineering and management principles to managing projects and finance in multidisciplinary environments
PO 12	Engage themselves in independent and life-long learning to continuing professional practice in their specialized areas of mechanical engineering

Course Outcome Versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2	3											1
CO3	3	3			2							1
CO4	3	3			2							1
CO5	3	3			2							1

1: Slight(low), 2 –Moderate (Medium), 3- Substantial(high), Blank - No correlation

Program Specific Objectives (PSOs):

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING LEARNING STRATEGY	Assessment Method &Schedule
1	Structure of Metals: metallic crystal structures: BCC, FCC and HCP, crystallization,	CO1	Calculate PF of bcc and fcc unit cells.	Lecture Discussion Problem solving	Assignment-I Mid-I Quiz-I
2	crystal imperfections: point, line, interstitial and volume defects; plastic deformation: slip and twinning	CO1	Explain Crystal imperfections?	Lecture Discussion	Assignment-I Mid-I Quiz-I

3	Constitution of Alloys: substitutional and interstitial solid solutions	CO1	What are Hume- Rothery rules?	Lecture Discussion	Assignment-I Mid-I Quiz-I
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The students must attain the knowledge and skills to

PSO-1:	Design, analyze and optimize mechanical systems along with control mechanisms
PSO-2:	Manufacture mechanical components by selecting effective processing methods and efficient tools
PSO-3:	Design, analyze evaluate thermal systems

Course Outcomes Versus Program Specific Outcomes:

Cos	PSO1	PSO2	PSO3
CO-1		3	
CO-2		3	
CO-3		3	
CO-4		3	
CO-5		3	

1: Slight(low), 2 –Moderate (Medium), 3- Substantial(high), Blank - No correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam
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Teaching-Learning and Evaluation

4	binary phase diagrams: isomorphous system, eutectic, peritectic, eutectoid and peritectoid reactions	CO1	Explain the construction of a binary equilibrium diagram.	Lecture Discussion Problem solving	Assignment-I Mid-I Quiz-I
5	Iron-Iron Carbide Diagram: Iron-Iron Carbide diagram and microstructural aspects of ferrite, cementite, pearlite, austenite and ledeburite	CO2	Sketch and explain Fe- Fe ₃ C equilibrium diagram.	Lecture Discussion Problem solving	Assignment-I Mid-I Quiz-I
6	Plain carbon steels and their applications	CO2	Explain the properties and applications of plain carbon Steels	Lecture Discussion	Assignment-I Mid-I Quiz-I

7	Heat Treatment of		Steels:CO3	Discuss	various
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caseLectureAssignment-I annealing, normalizing,hardening methodsDiscussionMid-I
 Quiz-I hardening and tempering, TTT diagrams, austempering, martempering, case hardening methods

8	Alloy Steels: Effect of alloying elements on Iron-Iron carbide diagram, Hadfield manganese steel, stainless steels, tool steels, HSS	CO3	What are the properties and applications of stainless steels	Lecture Discussion	Assignment-I Mid-I Quiz-I
9	Mid-I				
10	Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.	CO3	Explain the structure, properties and applications of cast irons	Lecture Discussion	Assignment-II Quiz-II Mid-II

11	Copper base alloys	CO4	What are stress corrosion cracking and dezincification	Lecture Discussion	Assignment-II Quiz-II Mid-II
12	Aluminum base alloys	CO4	Discuss the properties and application of aluminum base alloys	Lecture Discussion	Assignment-II Quiz-II Mid-II
13	Titanium alloys base	CO4	What are the effects of alloying elements in titanium base alloys	Lecture Discussion	Assignment-II Quiz-II Mid-II
14	Polymeric Materials: Structure and properties of polymeric materials and their applications	CO4	Distinguish between thermosets and thermoplastics	Lecture Discussion	Assignment-II Quiz-II Mid-II
15	Ceramics, abrasive materials, Nanomaterials- definition, properties and applications for the above.	CO5	What are the characteristics of ceramic materials?	Lecture Discussion	Assignment-II Quiz-II Mid-II
16	Composite Materials: Particle reinforced materials, fiber reinforced materials	CO5	Discuss various types of fibers used in composites	Lecture Discussion	Assignment-II Quiz-II Mid-II
17	metal ceramic and polymeric matrix composites and C-C composites.	CO5	What are the applications of ceramic matrix composites	Lecture Discussion	Assignment-II Quiz-II Mid-II
18	Mid-II				
19	End Semester				