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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Automobile Engineering

Semester End Examination; March / April - 2022

Material Science and Metallurgy

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Ability to identify different types of crystalline structure, defects of metals and laws governing the diffusion phenomena.

CO2: Ability to apply the knowledge of mechanical behavior to select appropriate material for given automotive component.

CO3: Ability to Interpret the phase diagrams of metals and alloys and use them in thermal processing of the materials.

CO4: Ability to Select appropriate heat treatment process for specific requirements.

CO5: Describe the effect of alloying elements on properties and fabrication process and applications of composite materials with economic and social concerns.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*

II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for Maximum of* ***18 marks*** *from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	List the mechanical characteristic that needs to be processed for the components made of steel alloys exposed to external stresses and forces.	2	L1	CO2	PO1
b.	How can thermal fatigue be prevented?	2	L2	CO1	PO1
c.	Define constitution point with reference to Cu-Ni equilibrium diagram.	2	L1	CO3	PO1
d.	Discuss tempering heat treatment process.	2	L2	CO4	PO1
e.	Give the classification of reinforcements based on diameter and material type.	2	L1	CO5	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Discuss the BCC crystal structure with a neat figure along with its characteristics. List at least two metals that possess this structure.	9	L2	CO1	PO1
b.	Draw a typical stress-strain diagram of mild steel subjected to tensile loading and discuss its characteristics.	9	L2	CO2	PO1
c.	i) Distinguish between Engineering Stress and True stress.	3	L3	CO3	PO1
	ii) A tensile stress is to be applied along with long axis of a cylindrical brass rod that has a diameter of 10 mm. Determine the magnitude of the load required to produce a 2.5 x 10^{-3} mm change in diameter if the deformation is entirely elastic. (Take E = 97 GPa and θ = 0.34).	6	L3	CO3	PO2

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	UNIT - II	**18**		
2 a.	With neat sketches, discuss the stages in cup and cone fracture.	9	L2	CO2 PO1
b.	List and discuss the distinct steps by which the fatigue failure is characterized.	9	L2	CO2 PO1
c.	i) Discuss brittle fracture.	5	L2	CO2 PO1
	ii) Write a note on creep.	4	L2	CO1 PO1
	UNIT - III	**18**		
3 a.	Draw Fe-C equilibrium diagram and discuss the phases.	12	L3	CO3 PO1
b.	Explain the steps involved in construction of T-T-T diagram.	6	L2	CO3 PO1
c.	Discuss the solidification mechanism in pure metals. How do you distinguish homogeneous and heterogeneous nucleation?	6	L2	CO2 PO1
	UNIT - IV	**18**		
4 a.	Explain briefly annealing and normalizing heat treatment processes. Also list the differences between the two.	9	L2	CO4 PO1
b.	Discuss the objectives of heat treatment process and explain the hardening process.	9	L2	CO4 PO1
c.	With neat sketches, discuss flame hardening and induction hardening.	9	L2	CO4 PO1
	UNIT - V	**18**		
5 a.	Discuss the properties, composition, and uses of grey C.I., white C.I. and Spheroidal C.I.	9	L2	CO2 PO1
b.	Discuss the applications of composites.	9	L2	CO5 PO1
c.	With a neat sketch, discuss the manufacture of fibre reinforced composite using pultrusion process.	9	L2	CO5 PO1

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