Question Paper

Exam Date & Time: 28-Nov-2019 (09:00 AM - 12:00 PM)



Department of Mechanical and Manufacturing Engineering THIRD SEMESTER B.TECH (IPE) END SEMESTER EXAMINATIONS, NOV 2019 SCIENCE AND MECHANICS OF MATERIALS [MME 2159]

Marks: 50

Duration: 180 mins.

Instructions to Candidates:

Answer ALL questions Missing data may be suitably assumed

1)		Define the terms hardness, strain energy, factor of safety and yield strength of a material. Write the relevant equations if any.	(4)
	A)		
	В)	Sketch the following Miller Indices [210], [111], (212).	(3)
	C)	Show that the vacant space present in simple HCP cell is 26% by assuming appropriate height for the ideal HCP cell. For the same value of co-ordination number and packing factor Why HCP is stronger than FCC.	(3)
2)		What are the assumptions made in deriving the torsion equation? Explain the meaning of polar modulus of section for circular solid and hollow shafts with appropriate equations.	(3)
	A) B)	Write the relevant stress and strain equations for thin cylinders. With sketches describe the failure pattern of thin cylinders due to stresses.	(3)
	C)	With relevant sketches explain mechanism of Homogeneous solidification process.	(4)
3)		Explain with examples, the conditions favouring the formation of different types of solid solutions.	(4)
	A) B)	A cast iron beam is of I section with upper flange 20 x 80 mm and lower flange 40 x 160 mm with overall depth 260 mm. The web is of 20 mm width. If the tensile stress is not to exceed 20 N/mm ² , find the safe UDL which the beam can carry assuming the beam length as 5 m. Find also the maximum compressive stress.	(3)
	C)	An I section beam 350 x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN. Find the maximum shear stress developed in the beam section.	(3)
4)	A)	Sketch the variation of shear force and bending moment along the 7 m span of a simply supported beam. Assume the beam is subjected to UDL of 10 kN/m for 3 m length from left support and 5 kN/m UDL for a length of 2 m from right support. Indicate the values at all salient points in SFD and BMD.	(4)
	B)	Melting temperatures of pure metals 'A' & 'B' are 1000°C and 800°C respectively. The metals 'A' and 'B' are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy	(3)

containing 40% A completely transforms into a mixture of two solid solutions at 600°C. Maximum solubility of 'A' in 'B' and 'B' in 'A' are 10% and 20% respectively at 600°C, 5% and 10% respectively at 0°C. Assuming the curves to be linear, draw phase diagram to scale and label the regions. For 40% B alloy determine the following:

- a. Start and End of solidification temp.
- b. Weight ratio of the solid phases in the eutectic mixture.
- C) With phase diagram and any two cooling curves, sketch the binary phase diagram where the (3) components show complete liquid solubility and solid insolubility. Also name the system.
- 5) Neatly sketch Iron-Cementite equilibrium diagram with all the phases. List the variant invariant (4) reaction involved in Fe-Fe₃C diagram.

A)

- B) What is meant by elastic curve? Write the differential equation of deflection of beams and derive the (3) equation for maximum deflection for a simply supported beam subjected to UVL on the entire span.
- C) Derive the relation between bending stress and radius of curvature for a beam subjected to bending (3) moment M.

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