Question Paper

Exam Date & Time: 20-Dec-2019 (08:30 AM - 11:30 AM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

Department of Mechanical and Manufacturing Engineering
IPE THIRD SEMESTER B.TECH END SEMESTER (MAKE UP) EXAMINATIONS, DEC. 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 Poisson's ratio, thermal stress, toughness of a material and true stress. Write relevant equations if any.	(4)
	A)		
	B)	Sketch the following Miller Indices [110], [210], (111).	(3)
	C)	Show that the vacant space present in simple FCC cell is 26%.	(3)
2)		What are the assumptions made in simple theory of bending? Explain the meaning of section modulus for solid and hollow rectangular sections with appropriate equations.	(3)
	A)		
	B)	With usual notations write the Lame's stress equations for thick cylinders and show the variation of these stresses across the wall thickness.	(3)
	C)	List the difference between Homogeneous and Heterogeneous nucleation.	(4)
3)		Explain with examples, Hume Rothery rule for the formation of substitutional solid solution.	(4)
	A)		
	B)	The I section of a beam has dimensions of upper and lower flange as 11.5 x 100 mm with overall depth 225 mm. The web is of 7.5 mm width. If the maximum permissible bending stress is 80 N/mm^2, what concentrated load can be carried at a distance of 4 m from one support?	(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. Also sketch the distribution of shear stress and indicate the values at all salient points.	(3)
4)		Sketch the variation of shear force and bending moment along the 8 m span of a simply supported beam. Assume the beam is subjected to UDL of 10 kN/m for 4 m length after 1m from left support. Indicate the values at all salient points in SFD and BMD.	(4)
	A)		
	B)	Melting temperatures of Lead and Tin are 330^{o}C and 230^{o}C respectively. The metals Lead and Tin are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy containing 30% Lead completely transforms into a mixture of two solid solutions at 180^{o}C. Maximum solubility of Tin in Lead and Lead in Tin are 20% and 10% respectively at 180^{o}C, 10% and 5% respectively at 50^{o}C. Assuming the curves to be linear, draw phase diagram to scale and label the regions. For 20% Lead alloy draw the cooling curve and determine the following:	(3)

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 Type-2 Eutectic binary phase diagram. (3)

5) Neatly sketch Iron-Carbon (Fe-C) equilibrium diagram with all the phases. (4)

A)

B) Derive the equation for maximum deflection and slope at any one support for a simply supported beam subjected to UDL on the entire span. (3)

C) With usual notations derive the torsion equation for a rotating circular shaft of diameter, d and subjected to torque T. (3)

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