Total No. of Questions – [09] Total No. of Printed Pages: 03

G.R. No.	

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F. Y. M. TECH. (Mechanical Design Engineering)

(SEMESTER - I)

COURSE NAME: ADVANCED STRESS ANALYSIS

COURSE CODE: MEPA11181

P118-151(ESE)

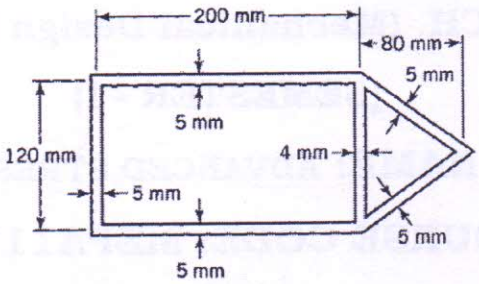
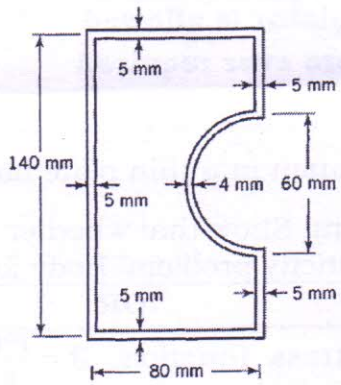
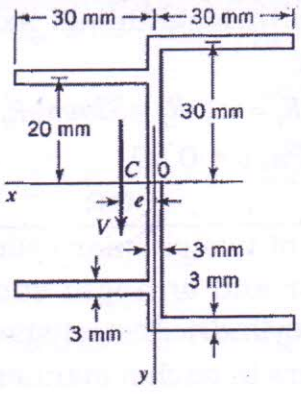
(PATTERN 2018)

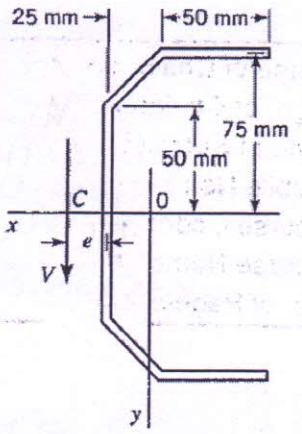
Time: [3 Hour] [Max. Marks: 50]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4 OR Q.5, Q.6 OR Q.7, Q.8 OR Q.9**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q. 1 a	The strain distribution in a thin plate has the form $\begin{bmatrix} ax^3 & axy^2 \\ axy^2 & ayx^2 \end{bmatrix}$ where 'a' is constant. Show that whether this strain field is a valid solution of an elasticity problem. Body forces are neglected.	03
	OR	
Q. 1 b	Prove that the stress function, $\emptyset = \frac{Pr\theta}{\pi}\sin\theta$ is a valid stress function. Where P is load per unit length.	03
Q. 2 a	A fatigue testing machine tool is used to determine fatigue life under rolling contact consist of a steel toroid (body 2) and steel cylinder (body 1), with longitudinal axis parallel to each other. Determine B/A ratio. Where, $R_1 = 32mm$, $R_1' = \infty$, $R_2 = 32mm$, $R_2' = 20mm$, For steel E = 200 GPa, υ = 0.29	03
	OR	
Q. 2 b	A feed roll consists of two circular cylindrical steel rollers, each 200 mm in diameter and arranged such that their longitudinal axes are parallel. A cylindrical steel shaft (60 mm in diameter) is fed between the rollers in such a manner that its longitudinal axis is perpendicular to that of the rollers. The total load P between the shafts. Determine B/A ratio. Use E = 200 GPa and v = 0.29 for the shaft	03

Q. 3 a	Write short note on rectangular strain gauge rosette.	02
	OR	
Q. 3 b	Draw neat diagram of circular polariscope.	02
Q. 4	The aluminum (G = 27.1 GPa) hollow thin-wall torsion member in Fig 01 has the dimensions shown. Its length is 3.00 m. If the member is subjected to a torque T = 11.0 kNm, Determine the maximum shear stress and angle of twist.  Fig 01	14
	OR	
Q. 5	A torque T = 3.0 kN m is applied to the torsion member whose cross section is shown in Fig 02. Determine the maximum shear stress in the member and the angle of twist per unit length.  Fig 02	14
Q. 6	An extruded bar of aluminum alloy has the cross section shown in Fig 03. Locate the shear center for the cross section.  Fig 03	14
	OR	

Q. 7	A 4-mm-thick plate of steel is formed into the cross section shown in Fig 04. Locate the shear center for the cross section.  Fig 04	14
Q. 8	A glass fibre reinforced nylon composite contains E-glass fibres 30% by volume. Calculate the percentage of load carried by the fibres when the composite is loaded. The moduli of elasticity of the constituents are E (glass) = 72 GPa, E (nylon) = 2.8 GPa.	14
	OR	
Q. 9	An important part of a structure which currently is being made of an aluminum alloy having a modulus of elasticity of 60 GPa is to be replaced by a composite material consisting of E-glass fibres in nylon matrix. It is desired that while weight reduction is important, the specific modulus of the composite should not be lower than that of the current material. The direction of loading in the composite will be in the fibre direction. The density of aluminum alloy used is 2.8 X 10^3 kgf /m^3 . Determine variation in specific modulus and density. Take density of E-glass 2.55 X 10^3 kg/m^3 and modulus 72 GPa, Nylon density 1.14 X 10^3 kg/m^3 and modulus 2.8 GPa	14