D 90173 (Pages : 3) Name.....

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FIFTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, NOVEMBER 2015

ME/PTME 09 502—ADVANCED MECHANICS OF SOLIDS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *the questions.*

1. What is meant by strain tensor ?
2. Write the relationship between modulus of elasticity and modulus of rigidity.
3. Define plane strain.
4. What is meant by complementary energy ?
5. State Saint Venant's theory.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. At a point P in a body, $\sigma_x = 10{,}000\ N/cm^2$, $\sigma_y = -5{,}000\ N/cm^2$, $\sigma_z = -5{,}000\ N/cm^2$, $\tau_{xy} = \tau_{yz} = \tau_{zx} = 10{,}000\ N/cm^2$. Determine the normal and shearing stresses on a plane that is equally inclined to all the three axes.
7. Explain uniqueness condition.
8. Explain Lame's ellipsoid.
9. Locate the shear centre for an unequal I section.
10. Explain virtual work principle.
11. Discuss membrane analogy.

(4 × 5 = 20 marks)

Part C

Answer **all** *the questions.*

12. (a) A solid shaft of diameter 3.16 cm (shown in Fig.1 on page 2nd) is subjected to a tensile force P = 10,000 N and a torque T = 5000 N cm. At a point A on the surface, determine the principal stresses, the octahedral shearing stress and the maximum shearing stress.

Turn over

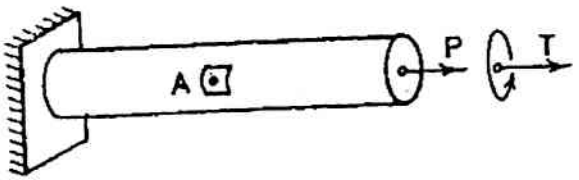

Fig. 1

Or

(b) Derive displacement equations of equilibrium.

13. (a) Analyze the bending of a beam under uniform load using polynomials.

Or

(b) Discuss the effect of a small circular hole in a large plate.

14. (a) The open link shown in Fig. 2 is loaded by forces P, each of which is equal to 15,000 N. Find the maximum tensile and compressive stresses in the curved end at section AB.

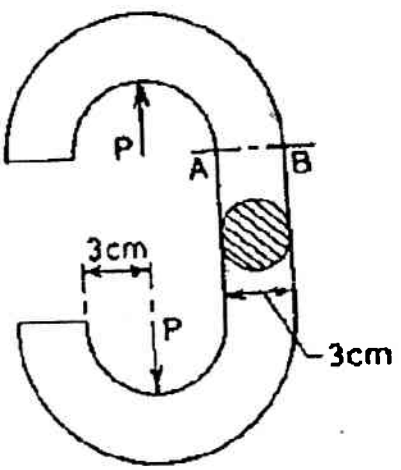

Fig. 2

Or

(b) The framework shown in Fig. 3 contains a redundant bar. All the members are of the same section and material. Determine the force in the horizontal redundant member.

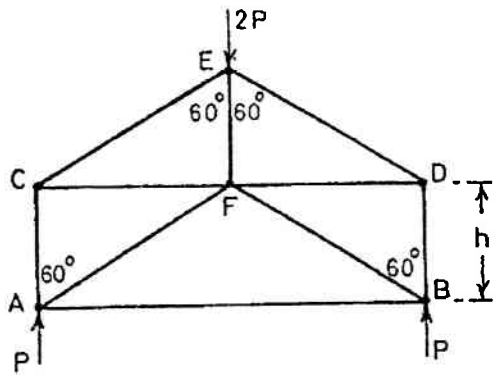

Fig. 3

15. (a) A shaft of elliptical section is subjected to torque of 2.5 kNm. If the maximum shear stress in the shaft is not to exceed 80 MN/m^2 determine :

(i) The major and minor axes, if major axis = 1.5 minor axis.

(ii) The angular twist per metre length.

Take : Modulus of rigidity = 80 GM/m^2.

Or

(b) Fig. 4 shows a two-cell tubular section as formed by a conventional airfoil shape, and having one interior web. An external torque of 10,000 Nm. is acting in clockwise direction. Determine the internal shear flow distribution.

The cell areas are as follows :

A1 = 680 cm^2.

A2 = 2000 cm^2.

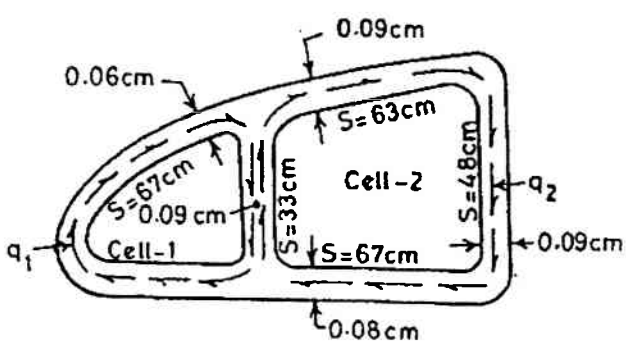

Fig. 4

(4 × 10 = 40 marks)