D 70316 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) (09 SCHEME) DEGREE EXAMINATION, NOVEMBER 2014

ME/PTME 09 502—ADVANCED MECHANICS OF SOLIDS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

I. 1 What is stress transformation ?

2 What is stress tensor ?

3 What is an interference fit ?

4 What is complementary energy ?

5 What is membrane analogy ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

II. (a) Distinguish between : stress and strain, normal stress and shear stress, working Stress and yield stress.

(b) Derive relation between Young's modulus and Bulk modulus.

(c) Find the slope of a simply supported beam at the support carrying a point load at the centre.

(d) Derive an expression for the shear stress produced in a circular shaft subjected to torsion.

(e) What is conjugate beam method for finding out the slope and deflection of a beam ?

(f) Explain Prandtle's stress function for torsion.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

III. (a) A compound bar consists of a central steel strip 25 mm. wide and 6.40 mm. thick placed between two strips of brass each 25 mm. wide and t mm thick. The strips are firmly fixed together to form a compound bar of rectangular section 25 mm. wide and $(2t + 6.4)$ mm. thick. Determine (i) the thickness of brass strips which will make the apparent modulus of elasticity of compound bar 1.57×10^5 N/mm^2. and (ii) the maximum axial pull the bar can then carry if the stress is not to exceed 157 N/mm^2, in either the brass or steel. Take the values of E for steel and brass as 2.07×10^5 N/mm^2. and 1.14×10^5 N/mm^2.

Or

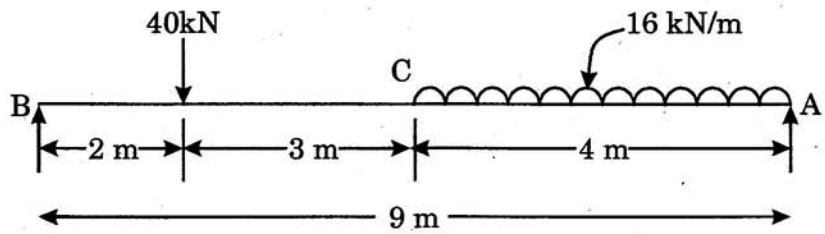
Turn over

(b) The modulus of rigidity of a material is 0.8×10^5 N/mm^2. When a 6 mm. × 6 mm. rod of this material was subjected to an axial pull of 3600 N it was found that the lateral dimension of the rod changed to 5.9991 mm × 5.9991 mm. Find the Poisson's ratio and the modulus of elasticity.

IV. (a) A hollow shaft of diameter ratio 3/5 is required to transmit 450 kW at 120 r.p.m. The shear stress in the short should not exceed 60 MPa and the angle of twist in a length of 2.5 m. must not exceed 1° using $C = 8 \times 10^4$ MPa, find the minimum internal diameter.

Or

(b) Draw shear force bending moment diagrams for the simply supported beam shown in Figure



V. (a) A beam consists of symmetrical rolled steel joint. The beam is simply supported at its end and carries a point at a centre of the span. If the maximum stress due to bending is 140 MPa, find the ratio of the depth of the beam section to span in order that the central deflection may not exceed 1/480 of the span.

Or

(b) A beam with span of 4.5 metres carries a point load of 30 kN at 3 metres from the left support. If for the section, $I_{XX} = 54.97 \times 10^{-6}$ m^4 and E = 200 GN/m^2, find

(i) The deflection under load ;

(ii) The position and amount of maximum deflection.

VI. (a) A rectangular bar of cross section 25 × 50 mm. is 500 mm. long. Determine maximum shear stress and total angle of twist if the torque of 600 Nm. is transmitted through the shaft. Let E = 200 Gpa, $\upsilon = 0.3$.

Or

(b) A built-up I section has an overall depth of 400 mm. width of flanges 300 mm thickness of flanges 50 mm and web thickness 20 mm. It is used as a beam with simply supported ends and it deflects by 10 mm. When subjected to a load of 40 kN/m length. Find the safe load on this I-section used as a column with both ends hinged. Use Euler's formula Assume a factor of safety 1.5 and take $E = 2 \times 10^5$ N/mm^2.

(4 × 10 = 40 marks)