Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech (Civil) (Sem.–3)

SOLID MECHANICS

Subject Code : CE-207

Paper ID : [A0604]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Answer briefly :

a) Draw a stress strain diagram for a mild steel specimen subjected to a tensile test.

b) Define Hoop stress.

c) What are the various assumptions made in Euler's theory?

d) Define the term equivalent length. Discuss its uses.

e) Define polar modulus of the shaft section.

f) Define torsional rigidity.

g) Explain various types of beams.

h) Define the term equivalent length. Discuss its uses.

i) Define Young's modulus of elasticity and Bulk modulus.

j) Define columns. Post and struts.

SECTION-B

Q2. A compound tube consists of a steel tube 150mm internal diameter and 10 mm thickness and on outer brass tube 170 mm internal diameter and 10 mm thickness. The two tubes are of the same length : The compound tube carries an axial load of 1000 kN, find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 150mm. Take Es = 2×10^5 N/mm^2 and Eb = 1×10^5 N/mm^2

Q3. Two planes AB and BC which are at right angles carry shear stresses of intensity 17.5 N/mm^2 while these planes also carry a tensile stress of 70 N/mm^2 and a compressive stress of 35 N/mm^2 respectively.

Q4. A simply supported beam of length 6m carries a triangular load whose intensity varies uniformly from zero at the left end to 60 kN/m at the right end. It has one support at 1.50 m from the left end and the other support at the right end. Draw SF and BM diagrams for the beam.

Q5. Find the greatest length of a mild steel rod 25 mm × 25mm which can be used as a compression member with one end fixed and other end free to carry a working load of 35 kN. Allow a factor of safety of 4. Take $\alpha = 1/7500$ and $f_c = 320$ N/mm^2.

Q6. A metal bar 10mm diameter when subjected to a pull of 23.55 kN gave an elongation of 0.30 mm on a gauge length of 200 mm. In a torsion test on the same material, a maximum shear stress of 40.71 N/mm^2 was measured on a bar of 50 mm diameter, the angle of twist measured over a length of 300 mm being 0° 21′. Determine the Poisson's ratio of the material.

SECTION-C

Q7. A 12 mm diameter steel rod passes centrally through a copper tube 48 mm external and 36 mm internal diameter and 2.5 m long. The tube is closed at each end by 24 mm thick steel plates which are secured by nuts. The nuts are tightened until the copper tube is shortened in length by 0.508 mm. The whole assembly is then raised in temperature by 60°C. Calculate the stresses in copper and steel before and after the rise in temperature, assuming that the thickness of the plates remain unchanged.

Take Es = 2.1×10^5 N/mm^2, Ec = 1.05×10^5 N/mm^2, $a_s = 1.2 \times 10^{-5}$ per °C, $a_c = 1.75 \times 10^{-5}$ per °C

Q8. Derive relationship between Young's modulus and modulus of rigidity.

Q9. Two rectangular plates, one of steel and other of brass each 37.5 mm by 10 mm are placed together to form a beam 37.5 mm wide and 20 mm deep on two supports 750 mm apart the brass component being on the top of the steel component. Determine the maximum central load if the plates are :

a) Separate and can bend independently.

b) Firmly secured throughout their length. Permissible stresses for brass and steel are 70 N/mm^2 and 100 N/mm^2. Take Eb = 0.876×10^5 N/mm^2 and Es = 2.10×10^5 N/mm^2.