

Roll No.

Total No. of Questions : 09]

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Paper ID [CE207]

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B.Tech. (Semester - 3rd)

SOLID MECHANICS (CE - 207)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 x 2 = 20)

- a) Define Young's modulus.
- b) Define factor of safety.
- c) What do you mean by a principal plane?
- d) What is meant by point of contraflexure? Show it on a beam.
- e) What do you understand by section modulus?
- f) Where do we use closed coiled helical springs?
- g) Define Torsional Rigidity.
- h) Define resilience and proof resilience.
- i) Differentiate between column and strut.
- j) List the various theories of elastic failure.

Section - B

(4 x 5 = 20)

Q2) Differentiate between upper and lower yield point. Show ultimate stress and breaking stress on a stress-strain curve.

Q3) Two wires, one of steel and other of copper, have the same length and are subjected to equal axial tensile forces. The copper wire has a diameter of 1 mm. What is the diameter of the steel wire if both wires are elongated by the same amount?

- Q4) Derive the relations for the principal stresses and principal strains.
- Q5) Two lengths of shaft 15 cm diameter are connected by a flange coupling with 6 bolts on a 25 cm diameter pitch circle. If the limits of shearing stress are 48 N/mm^2 in the shaft and 40 N/mm^2 in the bolts (assume uniform), calculate the power transmitted at 280 rpm and the diameter of the bolts required.
- Q6) A steel bar of 500 mm length, 30 mm width and 20 mm thickness is subjected to a direct tensile load of 60 kN. If Young's modulus of the bar material is 200 GN/m^2 , find the strain energy and resilience of the bar. Find also the modulus of resilience if the elastic limit for the material in tension is 220 N/mm^2 .

Section - C

(2 x 10 = 20)

- Q7) Draw the S.F. and B.M. diagram for a cantilever of length L carrying a point load W at the free end.
- Q8) A wooden beam of 10 cm breadth and 10 cm depth is used as a simply supported beam over a span of 4 meters. If Young's Modulus of elasticity for wood is 10 kN/mm^2 , what magnitude of a central load W will this beam carry to cause deflection of 2 mm at the center? Find the slope at the ends and also deflection at each meter length. Express maximum deflection as a percentage of span.
- Q9) An aluminum strip of rectangular cross section, 80 mm deep and 40 mm wide is bent into an arc of radius 100 m. Find:
- Maximum tensile stress developed
 - Maximum compressive stress developed
 - BM applied.
 - Concentrated load at the center if simply supported
 - UDL over the entire span if simply supported
 - Concentrated load at the free end if acting as a cantilever
 - UDL over the entire span if acting as a cantilever
 - Moment of resistance if the ultimate tensile stress is 280 N/mm^2 with a factor of safety of 2.5. Take $E = 70 \text{ GN/m}^2$ and length as 4 m.