[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
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B. Tech 3rd Semester Examination

Strength of Materials-I (O.S.)

ME-3003

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, Select one question from each section A, B, C, D. Section E is compulsory.

SECTION - A

1. The stresses on two perpendicular planes through a point in a body are 60 MPa and 15 MPa alongwith shear stress of 25 MPa. Find

   (a) Magnitude and direction of Principal stresses.

   (b) Stress conditions on a plane of maximum shear stress.

   (c) Normal and shear stress on plane inclined at 30° in anti-clockwise sense to the plane having normal stress as 60 MPa. **(15)**

2. Explain the various theories of failure with their graphical representations and relevance. **(15)**

SECTION - B

3. Find the deflection at the free end of a cantilever beam carrying a uniformly distributed load on the entire span using strain energy method. **(15)**

4. A vertical composite tie bar rigidly fixed at the upper end consists of steel rod of 16 mm diameter enclosed in a brass tube of 16 mm internal diameter and 24 mm external diameter, each being 2 m long. Both are fixed together at ends. The tie bar is suddenly loaded by a weight of 8 kN falling through a distance of 4 mm. Determine the maximum stresses in the steel rod and the brass tube. E_s = 205 GPa and E_b = 100 GPa. **(15)**

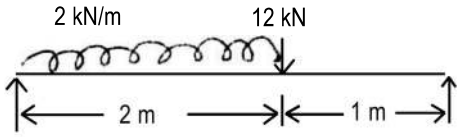
SECTION - C

5. An 800 mm long shaft with a diameter of 80 mm carries a flywheel weighing 4 kN at its midway. The shaft transmits 24 kW at a speed of 240 rpm. Determine the Principal and the maximum shear stresses at the ends of a vertical and horizontal diameter in a plane near the flywheel. **(15)**

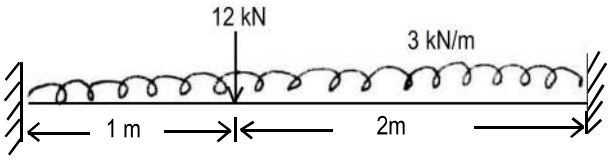
6. Derive Euler's formulae for the elastic buckling in case of one end fixed and other end hinged. State the assumptions and limitation of this formula. **(15)**

SECTION - D

7. Find deflection at the point of application of point load in the simply supported beam shown in figure below by moment area method. **(15)**



8. Draw SFD and BMD for the beam shown below. **(15)**



SECTION - E

9. (a) Show that complimentary shear stress is equal in magnitude to that of shear stress.

(b) State and prove Castigliano's theorem.

(c) Derive expression for deflection in open coiled helical spring under twisting moment.

(d) Find ratio of maximum shear stress to mean shear stress in case of rectangular cross-section of beams.

(e) Define middle third rule for short strut of rectangular cross-section.

(f) Derive formula for maximum deflection of cantilever supporting a point load at free end.

(g) Derive relationship between bending moment and shear force in beams.

(h) Stress conditions at a point are that of pure shear of magnitude 50 MPa. What is the magnitude of Principal stress at that point? **(5×8=40)**