Exam.Code:0939
Sub. Code: 6702

2074
B.E. (Mechanical Engineering)
Third Semester
MEC-302: Mechanics of Materials

Time allowed: 3 Hours | Max. Marks: 50

NOTE: *Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.*

x-x-x

I Attempt the following (5*2=10)

a) Differentiate statically determinate and indeterminate axially loaded bar.

b) Sketch the bending and shear stress distribution for a 'I' section.

c) Define Inelastic Bending

d) What is Absolute Maximum Shear stress?

e) What is strain energy?

UNIT -I

II a) The 1.5 m concrete post is reinforced with six steel bars, each with a 28 mm diameter. Knowing that Es = 200 GPa and Ec = 25 GPa, determine the normal stresses in the steel and in the concrete when a 1550 kN axial centric force P is applied to the post as shown in **Fig. 1.**

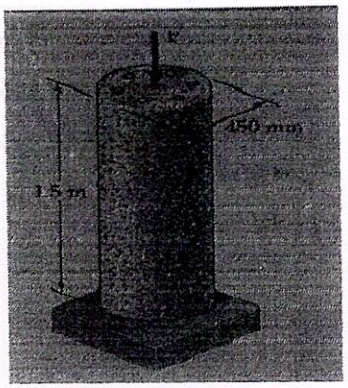

Fig. 1

b) A copper rod and a steel rod are joined together as shown in **Fig. 2**. There is a gap of 0.1 *mm* between the rigid support and the end of the bar at 27 °C. Determine the stresses in the bars when the temperature becomes 50 °C. E for steel = 200 *GPa* & E for copper =120 *GPa*. α for steel = 12×10^{-6} /°C & α for copper =16×10^{-6} /°C

Fig. 2 **(5, 5)**

P.T.O

III a) Draw stress – strain diagram for brittle material, ductile material and indicate salient points.

b) Derive the relation between elastic constants (E, G and K). **(5,5)**

IV a) A hollow shaft of diameter ratio 3/8 required to transmit 600 kW at 110 rpm, the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and the twist in a length of 3 m not to exceed 1.4 degrees. Determine the diameter of the shaft. Assume modulus of rigidity for the shaft material as 84 GN/m^2

b) Estimate the values of change in length, breadth and thickness of a steel bar 4.2m long, 35mm wide and 25mm thick. When subjected to an axial pull of 130kN in the direction of its length. Take E=200Gpa and poisson's ratio = 0.3

(5,5)

UNIT -II

V a) The simply supported beam carries a vertical load that increases uniformly from zero at the left end to a maximum value of 8000 N/m at the right end. Draw shear force and bending moment diagram.

b) A thin cylindrical shell 1.5 m long, internal diameter 300 mm and wall thickness 10 mm is filled up with a fluid at atmospheric pressure. If the additional fluid of 300×10^3 mm^3 is pumped in the shell, find the pressure exerted by the fluid on the shell. Take E = 2.0×10^5 N/mm^2 and 1/m=0.3. Also find the hoop stress induced.

(5,5)

VI (a) Discuss the following with example

(i) Elastic and Inelastic bending (ii) Unsymmetric Bending

(b) A rectangular beam 300 mm deep is simply supported over a span of 4 m. Determine the uniformly distributed load per meter which the beam may carry. If the bending stress should not exceed 120 N/mm^2. Take I = 8×10^6 mm^4. **(5,5)**

VII Rolled steel "T" beam is simply supported over span of 4 m carries u.d.l. of 20 kN/m. Both flanges of I-section are 300 mm wide and 50 mm thick and web is 300 mm deep and 50 mm thick. Find the shear stress distribution across a section 1 m away from the support. **(10)**

x-x-x