GANPAT UNIVERSITY

.Tech. 3rd Semester (Mechatronics), Regular Examination : Nov- Dec : 2012	2MC 306 STRENGTH OF MATERIALS
Instructions: -	Invigilator's Sign.: _____
(1) Answer to the two sections must be written in separate answer books.	Exam. No. of the candidate: _____
(2) Assume suitable data if required.	Max. Marks: 70
(3) Figures to the right indicate full marks.	Max.Time: 3 Hours

Section - I

1 (A) Explain on (1) Flitched beam and (2) Neutral Plane and Neutral axis (05)

OR

1 (A) Derive classic flexural formula based on theory of pure bending. (05)

1 (B) A cantilever beam of span 3m carries a point load 20 kN at its free end. The beam has semicircular cross section of diameter 300 mm and has its diameter at bottom. Calculate maximum safe span length of beam if tensile stress and compressive stress are limited to 200 MPa and 100 MPa respectively. (06)

2 Attempt any Two: (12)

(A) Prove that shear stress distribution equation for rectangular section of a beam.

(B) A short column of external diameter D and internal diameter d carries an eccentric load P. Find the maximum eccentricity of the load that cannot produce tension in the cross section.

2 (C) At a given section of I beam, the value of vertical shear force is 50 kN and the sectional dimensions are Flange width (top and bottom) = 200 mm, Flange thickness (top and bottom) = 25 mm; web thickness =50 mm and total depth =300 mm. Draw the shear stress distribution diagram for the given section.

3 Attempt any Two: (12)

(A) The principal stresses at a point in a strained material are 45 N/mm^2 both are like stress. Find analytically and graphically the normal, tangential and resultant stresses on a plane inclined at 45° with principal planes.

(B) Explain clearly, the analytical method of finding out stresses in a rectangular element subjected to normal stresses σ_1 and σ_2 and shear stress (s) .Using the same method, find out principal planes and principal stresses.

(C) A rectangular beam is cantilever supported at the end and carries a point load at the free end. Prove that the ratio of span to depth $= \frac{\text{Maximum Bending Stress}}{4 \times \text{Maximum Shear Stress}}$

Section – II

4 (A) Derive expressions to find out the equation for slope and deflection of simply supported beam carrying Central point load W by Using Double Integration method. (05)

(B) A simply supported beam of 6m span is subjected to a concentrated load of 18 kN at 4m from left support. Calculate (i) the position and the value of maximum deflection (ii) Slope at mid span (iii) Deflection at the load point. Take E=200 GPa, $I=15*10^6$ mm^4. (05)

(C) Define the term Slope and Deflection. (02)

OR

4 (A) Show that in thin cylindrical shells subjected to internal fluid pressure, the circumferential stress is twice the longitudinal stress. (05)

(B) A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure: length =1.2 m, external diameter= 20cm, thickness of metal= 8mm. Find the value of pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25 cm^3 of liquid is pumped into the cylinder. Take E= 2.1×10^5 N/mm^2 and Poisson's ratio = 0.33. (05)

(C) Differentiate between a thin and thick cylinder. (02)

5 (A) Derive an expression for the Euler's crippling load for a long column with One end is fixed and other is hinged. (06)

(B) Determine the external diameter and internal diameter of a hollow circular cast iron column, which carries a load of 1000 kN. The length of the column is 6 metre. The internal diameter is to be one half that of outer diameter. Use Rankine's formula with f = 560 N/mm^2 and α = 1/1600. Take a factor of safety 4. One end is fixed and the other end is free. (05)

OR

5 (A) Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. What are the assumptions made in the derivation? (06)

(B) A solid cylindrical shaft is to transmit 300kW power at 100 r.p.m. (05)

I. If the shear stress is not to exceed 80N/mm^2, find its diameter.

II. What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same?

6 (A) What are the different types of riveted joint? Explain clearly with neat sketches. (05)

6 (B) A cylindrical boiler is made of 12 mm steel plate. Its longitudinal joint is lap riveted with two row of 25 mm diameter rivets. The pitch of one row of rivets is 120 mm and that in the second row 60 mm. using working stresses σt = 112 MPa in tension, τ = 84 MPa in shear, and σb = 158.5 MPa in crushing, find safe internal pressure 'p', if boiler is 1.5 m in diameter. What is the joint efficiency?

(C) Define the terms: Diagonal pitch, Rivet value (02)

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