GANPAT UNIVERSITY

B.Tech. 3rd Semester (Civil),
Regular Examination : Nov- Dec : 2011

C – 302: Mechanics of Structures

Instructions: -

(1) Answer to the two sections must be written in separate answer books.
(2) Assume suitable data if required.
(3) Figures to the right indicate full marks.

Invigilator's Sign.: _____

Exam. No. of the candidate: _____

Max. Marks: 70

Max.Time: 3 Hours

Section - I

1 (A) Write steps to draw Mohr's circle and also derive expressions for finding out normal, tangential and resultant stresses on an oblique plane in a rectangular element subjected to like stresses. (06)

OR

1 (A) Derive analytically expressions for finding out normal, tangential and resultant stresses on an oblique plane in a rectangular element subjected to like stresses. (06)

1 (B) The principal stresses at a point in a strained material are 60 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. (04)

1 (C) Define section modulus and modulus of rupture. (02)

2 (A) What is pure bending? Explain giving at least two examples. Also describe assumption made in theory of pure bending. (05)

2 (B) Prove that shear stress distribution in a rectangular section of a beam which is subjected to a shear force F is given by (06)

$$\tau = \frac{F}{2I}\left[\frac{d^2}{4} - y^2\right]$$

OR

2 (B) Prove that the maximum shear stress in a circular section of a beam is 4/3 times the average shear stress. (06)

3 Attempt any Two: (12)

(A) Direct stresses of 120 MN/m^2 in compression and 90 MN/m^2 in tension are applied to an planes at right angle to another. If the maximum principal stress is not to exceed 150 MN/m^2 in tension to what shearing stress cans the material be subjected?
What is then the maximum resulting shearing stress in the material?
Also find the magnitude of the other principal stress and its inclination to 120 MN/m^2 stress.

(B) 5 m span cantilever beam carries a uniformly distributed load of 20 kN/m on full span and at free end a point load of 10 kN. Beam has circular cross section of diameter D. If the maximum bending stress is 200 MPa, then find the diameter of circular section.

(C) A rectangular beam is cantilever supported and carries a uniformly distributed load at the entire span. Prove that the

$$\frac{L}{d} = \frac{\text{Maximum bending stress}}{2 \times \text{Maximum. shear stress}}$$

Section – II

4 Answer the following questions. (12)

(A) How will you find the maximum and minimum stress at the base of a symmetrical column when it is subjected to load which is eccentric to both axes?

(B) Prove that maximum shear stress at any point in a thin cylinder, subjected to internal fluid pressure is given by,

$$\tau_{max} = p\,d / 8\,t$$

(C) Define Slenderness ratio. State the limitations of Euler's Formula.

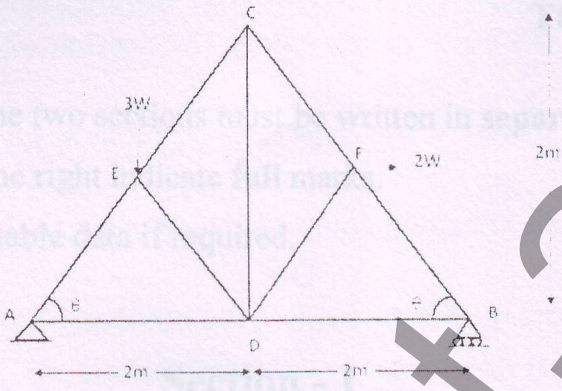
5 (A) Why it is necessary to study the frame structures? Mention and explain with figure the different types of frames, generally used. (06)

(B) Determine the ratio of buckling strength of two columns, one hollow and other solid both are made of same materials and have the same length, cross sectional area, end conditions. The internal diameter of hollow column is 2/3 rd of external diameter. (06)

OR

5 (A) Derive an expression for the Euler's Crippling load for a column with both ends is fixed. (06)

(B) Find the forces in members of frame, shown in fig. below by method of joint and draw the force table. Also find force in member AD, EC, ED by method of section. (06)



6 (A) Prove that for no tension at the base of a short column of rectangular section, the line of action of the load should be within the middle third (05)

(B) A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure: length =1.5m, external diameter= 30cm, 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 x 105 N/mm^2 and Poisson's ratio = 0.30 (06)

OR

6 (A) Derive an expression for closed coil helical spring subjected to an axial load along with neat sketch of closed coil helical spring. (06)

(B) A shaft is to be fitted with a flanged coupling having 8 bolts on a circle of diameter 100mm. The shaft may be subjected to either a direct tensile load of 400kN or a twisting moment of 18kNm. If the maximum direct and shearing stresses permissible in the bolt material are 135 N/mm^2 and 65 N/mm^2 respectively, find the minimum diameter of the bolt required. Assume that each bolt takes an equal share of the load or torque. (05)

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