GANPAT UNIVERSITY

B.Tech. 3rd Semester (Civil),
Regular Examination : Nov- Dec : 2012

2CI302:
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) A hollow circular pier having external and internal diameters of 200 mm and 180 mm respectively carries a vertical load of 75 kN at an eccentricity of 35 mm. What are the maximum and minimum stress intensities? (06)

OR

1 (A) A rectangular beam is simply supported and carries a uniformly distributed load at the entire span. Prove that the $\frac{\text{Maximum Bending Stress}}{2 \times \text{Maximum Shear Stress}} = \frac{L}{D}$ (06)

2 (A) Explain clearly, the graphical 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. (07)

(B) A rectangular block subjected to a direct tensile stress of 800 N/mm^2 along with shear stress. Determine the shear stress if major principal stress not to exceed 1200 N/mm^2 (tensile). Also find the minor principal stress. Check the answer by Mohr's circle method. (07)

OR

2 (A) Derive expressions for major and minor principal stresses by analytically method. Stresses on an oblique section of a body subjected to a uniaxial stress accompanied by a simple shear stress. (07)

2 (B) The principal stresses at a point in a strained material are 50 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. (0

(C) What do you mean by pure bending? Explain with at least two different examples. What are the assumptions made in the theory of simple bending? (04)

3 Attempt any Three: (15)

(A) Prove that the maximum shear stress in a rectangular section of a beam is 1.5 times the average shear stress.

(B) Compare the moment of resistance of a beam of square cross section of 200 mm X 200 mm when it is placed with its, (I) Sides horizontal and (II) Diagonal horizontal.

(C) A 12 cm by 5 cm I-section is subjected to a shearing force of 10kN. Calculate the shear stress at the neutral axis and at the top of the web. What percentage of shearing force is carried by the web? Given I= 220 x 10^4 mm^4, area = 9.4 x 10^2 mm^2, web thickness = 3.5 mm and flange thickness = 5.5 mm.

(D) A cast iron water pipe, 400 mm inside diameter and 450 mm outside diameter, is subjected at two points 8m apart. Find maximum stress in the metal, when the pipe is running full of water. The density of metal is $7gm/cm^3$ and that of water is 10 kN/m^3

Section – II

4 (A) Derive an expression for the Euler's Crippling load for a column with Both ends is fixed. (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 column is 6 meter. The internal diameter is to be one half of outer diameter. Use Rankine's formula with f_c = 560 N/mm^2 and α= 1/ 1600. Take factor of safety = 4. One end is fixed and other end is free. (06)

OR

4 (A) Distinguish between perfect frame and imperfect frame. Explain the method of joints. (06)

(B) Determine the forces in the members by method of joint as shown in Figure No - 1. (06)

4 (B)

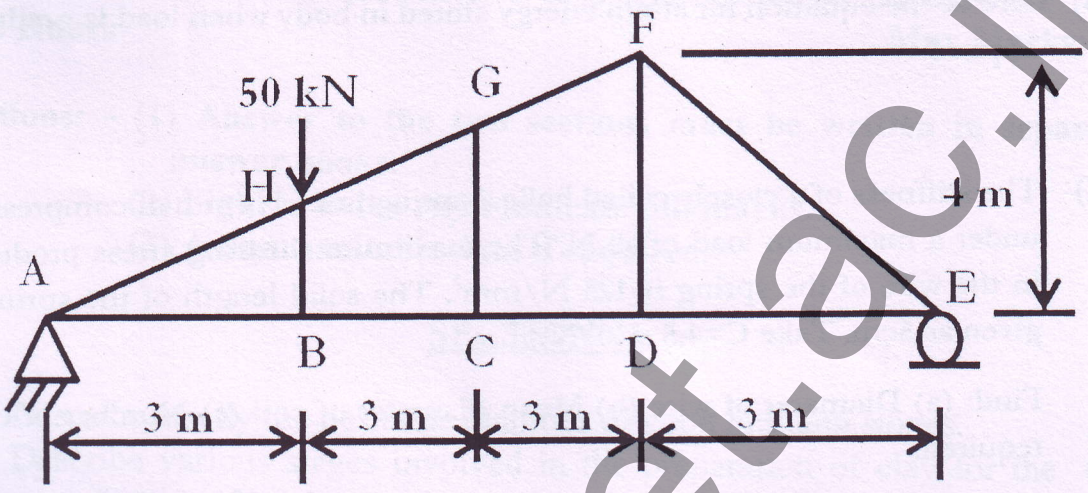

Figure No - 1

5 (A) Derive expressions for slope and deflection of beam of simply supported carrying a UDL of intensity w per unit length by using double integration method. (05)

(B) A simply supported RC beam of span 4 m and cross section 150 mm x 300 mm is loaded with 10 KN/m Udl load throughout the span and 50 KN point load at midpoint of span. Find the Maximum Slope and Deflection of the beam. Take $E = 2 \times 10^4$ N/mm^2 (06)

OR

5 (A) Differentiate between a thin and thick cylinder. 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 =1.2m, 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 x 10^5 N/mm^2 and Poisson's ratio = 0.33 (06)

6 Attempt any Two:

(A) Derive the torsion formula $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{r}$

(B) Derive the equation for strain energy stored in body when load is gradually applied.

(C) The stiffness of a closely coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire of the spring is 125 N/mm^2. The solid length of the spring is given as 5cm. Take $C=4.5 \times 10^4$ N/mm^2

Find: (a) Diameter of wire (b) Mean diameter of coil (c) Number of coils required.