GANPAT UNIVERSITY

B. Tech. CIVIL ENGINEERING (3rd Semester) Regular Examination – Nov/Dec : 2016

2CI302:MECHANICS OF STRUCTURES

Max.Time: 3 Hours **Max. Marks: 60**

Instructions: - (1) Answer to the two sections must be written in **separate** answer books.

(2) Figures to the right indicate **full** marks.

(3) Assume suitable data if required.

Section - I

1 (A) A cantilever beam of span L m carries a point load of 20KN at its free end. The beam has 125mm × 75mm × 10mm thick unequal angle section is placed with the longer leg vertical. Calculate maximum safe span length of beam if tensile stress and compressive stress are limited to 200 MPa and 100 MPa respectively. **(05)**

OR

1 (A) A cast iron water main 12 meters long of hollow rectangular section with external dimensions 200 mm × 400 mm and internal dimensions.100 mm × 200 mm, runs full of water and is supported at its ends. Calculate the maximum stress in the metal. If density of cast iron is 7200 kg/m^3 and that of water is 1000 kg/m^3. **(05)**

1 (B) Described the types of load, types of supports and types of beams with neat sketch. **(02)**

OR

1 (B) What is point of contra flexure? What is its significance? **(02)**

1 (C) A beam of circular solid section of 50 mm diameter is used as a cantilever of span 0.9 m. It carries a concentrated load of 10.5 KN at the free end. If the U.D.L. on the beam is 0.6 KN/mm, determine: (i) Maximum average shear stress anywhere in the beam (ii) Maximum shear stress anywhere in the beam (iii) Shear stress in a fiber at 10 mm from N.A. on a section located at 0.4 m from free end. **(03)**

OR

1 (C) A simply supported timber beam 150 mm wide × 300 mm deep is simply supported over a span of 4.5 m. it is loaded with a uniform load of 8 KN/m. Compute : (i) shear stress developed on a layer 60 mm above the neutral axis of a section located at 1.5 m from the left support. (ii) Maximum shear stress on the above section. (iii) Maximum shear stress anywhere in the beam. **(03)**

2 (A) A beam ABC 5 m long is supported at A (simply support) and B (roller support).The overhang BC is 2 m length. The overhang BC carries U.V.L. at intensity of 8 kN / m at C end and 0 kN / m at B end. In addition , there are a point load of 15 kN inclined at 30^0 acting at 2 m from A end and moment of 3 kN- m anti-clockwise at same point. Draw the S.F. and B.M. Diagram. **(07)**

2 (B) Define the simple bending and pure bending. Explain giving at least two examples. Also state the assumptions made in deriving bending stress equation. (03)

3 (A) Derive an expression for the shear stress at any point in a circular section of a beam, which is subjected to a shear force F. (04)

(B) A column is rectangular in cross-section of 300 mm x 400 mm in dimensions. The column carries an eccentric point load of 350 kN on one diagonal at a distance of quarter diagonal length from a corner. Calculate stress at all four corners & Draw stress distribution diagrams for any two adjacent sides. (06)

OR

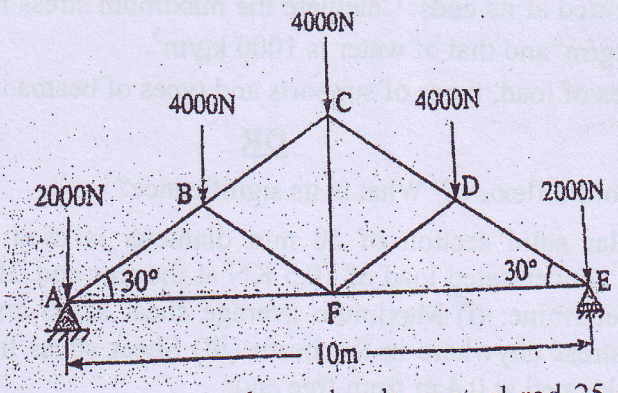
3 (A) Shown that for a rectangular section of the maximum shear stress is 1.5 times the average stress. (05)

(B) A small concrete dam, trapezoidal in cross section with on face vertical, is 8 m high, 1.5m wide at top and 3.2m wide at base. If it has to retain water up to depth 7.5m. Find maximum and minimum stresses generated at base and also sketch stress distribution diagram under the base of the dam. Consider unit weight of concrete and water as 25kN/m^3 and 10kN/m^3 respectively. (05)

Section - II

4 (A) A hollow cylinder 2 m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 KN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa. (05)

(B) Find out the force in the all member of truss using Method of Joint. (05)

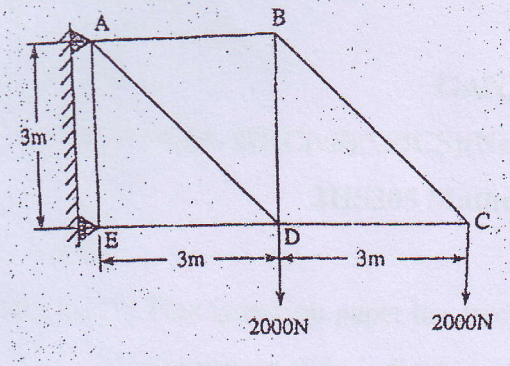


5 (A) Two parallel walls 6 m apart are stayed together by a steel rod 25 mm diameter passing through metal plate and nuts at each end. The nuts are tightened home,when the rod is at a temperature of 100^{0}C. Determine the stree in the rod,when the temprature falls down to 60 C if, (05)

a. The ends do not yield
b. The ends yield by 1 mm.

Take E= 200GPa and $\alpha=12\times10^{-6}$/C

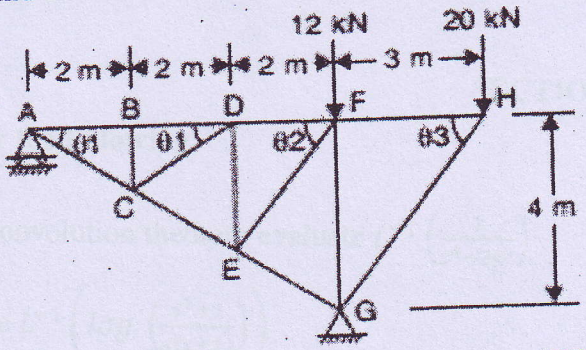
5 (B) Find out the force in the all member of truss using Method of Section. (05)



OR

5 (A) A Solid round bar 4m long and 6 cm in diameter is used as a strut. Determine the crippling load for the following conditions, (i) One end is fixed and other end is free (ii) Both ends are fixed (iii) One end is fixed and other is hinged. Take $E = 2 \times 10^5$ N/mm^2 (05)

(B) Find out the force in the all member of truss using Method of section. (05)



6 (A) The stresses at a point in a component are 150 MPa (Tensile) and 50 MPa (Compressive). Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 35^0 with compressive stresses. (05)

(B) Compare the torsional resistance of solid circular shaft and hollow circular shaft made from the same material and having same cross sectional area. The solid circular shaft is having 60 mm diameter and hollow circular shaft is having internal diameter 0.75 times the external diameter. (05)

OR

6 (A) Define principal planes and principal stresses and explain their uses. (05)

(B) The stiffness of a closely coiled helical spring is 1.5 N / mm^2 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 (when the coils are touching) is given as 5 cm. Find: (05)

(i) Diameter of wire
(ii) Mean diameter of coil
(iii)Number of coils required.

Take $C = 4.5 \times 10^4$ N/mm^2

" END OF PAPER"