Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester 3rd Civil Engineering, Regular Examination November – December: 2013

2CI302 - MECHANICS OF STRUCTURES

Time: 3 Hours

Total Marks: 70

Instruction:
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

Section - I

1 (A) What is pure bending? Explain giving at least two examples. (02)

(B) Mention the difference between Bending moment and Moment of resistance. (02)

(C) A beam of span L meter simply supported at ends carries a central point load W. The beam section is symmetrical about axis and has an overall depth of 290 mm with horizontal flanges each 150mm x 20mm and a vertical web 10mm thick. If the maximum shear stress is to be 45 N/mm^2. When the maximum bending stress is 150N/mm^2. Calculate the value of load W and the span. Sketch the shear stress and bending stress distribution diagrams. State the values of stresses for the both diagrams also. (07)

2 (A) Explain clearly, 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. (08)

(B) The normal stresses in two perpendicular directions are 600 MPa and 300 MPa both compressive. The shear stress and complementary shear stress are of intensity 450 MPa. (I) Find the normal and tangential stresses on the two planes which have the same inclination to the perpendicular planes carrying the normal stresses mentioned above. (II) Determine the principal planes and the values of principal stresses on it. For the above data. Show them with the help of a sketch. Conform the analytically results by the graphical method using Mohr's circle. (04)

OR

2 (A) A short column of diameter D and carries an eccentric load P. Find the maximum eccentricity of the load that cannot produce tension in the cross section. (02)

(B) A Short hollow pier of 1.2 m square section outer side and 1.0 m square section inside is subjected to a direct load of 120 kN along its outer edge point. Determine the final stresses at the base of the pier. Draw neat sketch of stress distribution diagram. (06)

(C) A hollow circular column having and internal diameters of 400 mm and 200 mm respectively carries a vertical load of 150kN at the outer edge of the column. Calculate the maximum and minimum intensities of stress in the section. (04)

3 (A) Derive the relation to find out the shear stress at any section. (04)

3 (B) Sketch the bending stress distribution diagram at the point of maximum bending moment for the beam loaded and having inverted T-section. Flange and web thickness are 20 mm. Flange width is 200mm. Overall depth of inverted T-section is 220 mm. A cantilever beam of length 2 m having a point load of 25 KN at center and a point load of 30 KN at free end. Also carries U.D.L. of 10 KN/m between two point loads. Also calculate the radius of curvature of the neutral layer at the maximum bending moment.

OR

3 (A) An unequal angle 150 mm × 75 mm, thickness of metal 8 mm with the longer leg vertical is used as a beam and carries a load of 6 KN/m. Over a span of 3 m. Find the maximum shear stress developed and sketch the distribution of shear stress across the section, shorter leg is on top & right side. (06)

(B) A circular beam is cantilever supported and carries a uniformly distributed load at the entire span. Prove that the (06)

$$\frac{L}{D} = \frac{1.33 \text{ X Maximum bending stress}}{\text{Maximum. shear stress}}$$

Section - II

4 (A) A hollow cylindrical cast iron column is 3.5 m long with both ends fixed. Determine minimum diameter of column, if it has to carry a safe load of 250 KN with a factor of safety of 5. Take the internal diameter as 0.7 times the external diameter. (04)

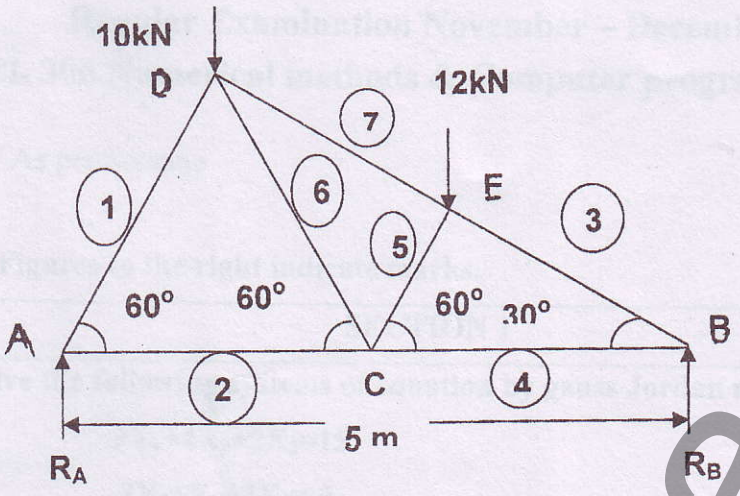
(B) Find out Euler's crippling load for a hollow cylindrical steel column of 38 mm diameter and 2.5 mm thick. Take the length of column as 2.3 m and hinged at both ends. Take E = 205 GPa. Also determine Rankine's crippling load by Rankine formula. $\alpha = 1/7500$ (04)

(C) A hollow cast iron column of 150 mm external diameter and 100 mm internal diameter is 3.5 m long. If one end of the column is rigidly fixed and the other is free. Find the critical load on the column. Assume modulus of elasticity for the column material as 120 GPa. (04)

OR

4 (A) Find the forces in the members AB,AC and BC of the truss if it is a shape of a triangle and BC is 7m and angle ABC=30^0 and angle BCA=60^0 and at A a load of 40KN is applied in the downward direction. (04)

(B) Determine the forces in all the members of truss as shown in the fig below using method of joints. (08)



5 (A) Write the assumptions made in the derivation of shear stress produced in a circular shaft subjected to torsion and derive the torsional formula with proper neat and clean diagram. (05)

(B) A solid shaft 60 mm in diameter transmit 80 KW at at 180 rev/min. Calculate the maximum shear stress induced and the angle of twist in degrees for a length of 8 meters. Consider G= 80 GPA. (06)

OR

5 (A) A cylindrical pipe of diameter 2.5 m and thickness 1.5 cm is subjected to an external fluid pressure of 4.2 N/mm^2 .Determine i)Longitudinal stress developed in the pipe and the circumferential stress developed in the pipe (05)

(B) A thin cylinder of internal diameter 1.25 contains a fluid at an internal pressure of $2N/mm^2$.Determine the maximum thickness of the cylinder if,(i) Longitudinal Stress is not to exceed $30N/mm^2$. (ii) The circumferential stress is not to exceed 45 N/mm^2. (06)

5 (A) Derive the relation for the strain energy when the load applied is suddenly (06)

(B) A tensile of 60 KN is gradually applied to a circular bar of 4 cm diameter and 5 m long. If the value for E= 2 X 10^5 N/mm^2,determine (i) stretch in the rod (ii)stress in the rod (iii)strain energy absorbed by the rod (06)

THE END