Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: 3rd Mechanical Engineering

Regular Examination November – December 2014

2CI302 - STRENGTH OF MATERIAL

Time: 3 Hours **Total Marks: 70**

Instruction: 1. All Questions are Compulsory.
2. Draw Sketches/ Figures wherever necessary which indicates full marks.
3. Assume suitable data wherever if necessary.

Section - I

Que. – 1 Attempt following question:

(A) What do you mean by 'simple bending' or 'pure bending? What are the assumptions made in the theory of simple bending? **06**

(B) Compare the moment of resistance of a beam of square cross section of 200 mm × 200 mm when it is placed with its, two sides horizontal and diagonal horizontal. **06**

OR

Que. – 1 Attempt following question:

(A) What do you understand by neutral layer and neutral axis? **03**

(B) Define section modulus and its importance in bending? **03**

(C) A cast iron water pipe 400 mm inside diameter and 450 mm outside diameter is supported at two points 8 m apart. Find max stress in the metal, when the pipe is running full. The density of metal is 7 gm/cm^3 and that of water is 10 kN/m^3. **06**

Que. – 2 Attempt following question:

(A) Figure no. 1 shows the stresses at a point. **05**

I. Find principal planes and principal stresses

II. Find the normal stress and shear stress on an inclined plane h-h inclined at 30° with vertical plane as shown in figure 1 using graphically as well as analytical method.

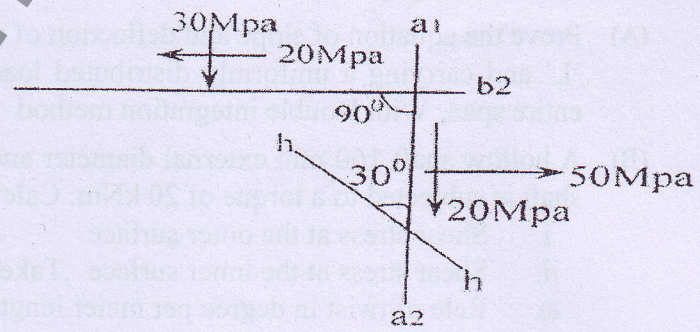

Figure 1

(B) A masonry pier of 3mX4m supports a vertical load of 80kN as in figure below. Find out

i. The stresses developed at each corner of the pier.
ii. What additional load should be placed at the center of the pier so that there is no tension on anywhere in the pier section?
iii. What are the stresses at the corners the additional load in the center.

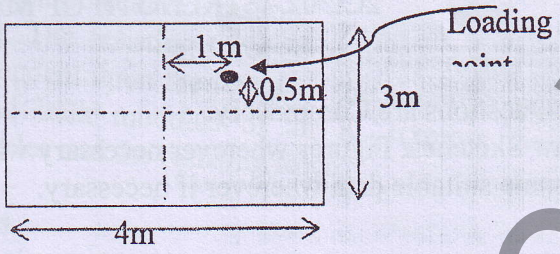

Figure 2

OR

Que. – 2 Attempt following question:

(A) A rectengular body is subjected to direct stresses in two manually perpendicular directions accompanied by a shear stress. Prove that the normal stresses and shear stresses on an oblique plane inclined at angle 'ɵ' with the plane of major direct stress are given by, **06**

$$fn = \frac{f1+f2}{2} + \frac{f1-f2}{2} cos2\theta + \tau cos2\theta \text{ and } ft = \frac{f1-f2}{2} sin2\theta - \tau cos2\theta$$

(B) A load of 75kN is carried by column made of cat iron. The external and internal diameters are 200mm and 180mm respectively. If the eccentricity of the load is 35mm find **05**

i. The maximum and minimum stress intenseness
ii. Up to what eccentricity there is no tensile stress in column?

Que. – 3 Attempt following question:

(A) Shown that for a rectangular section of the maximum shear stress is 1.5 times the average stress. **06**

(B) A rectengular beam is simply supported at the ends and carries a point load at the centre. Prove that the ratio of **06**

$$\text{span to depth} = \frac{Maximum\ bending\ stress}{2 \times Maximum\ shear\ stress}$$

Section – II

Que. – 4 Attempt following question:

(A) Prove the equation of slope and deflection of a simply supported beam of length 'L' and carrying a uniformly distributed load of 'w' per unit length over the entire span, With Double integration method **06**

(B) A hollow shaft 160 mm external diameter and 120 mm internal diameter, if the shaft is subjected to a torque of 20 kNm. Calculate **06**

i. Shear stress at the outer surface
ii. Shear stress at the inner surface ,Take C = 7.5×10^4 N/mm^2
iii. Rate of twist in degree per meter length of shaft.

OR

Que. – 4 Attempt following question:

(A) Determine using Macaulay's method: (i) slope at the left support, (ii) deflection under the load and (iii) maximum deflection of a simply supported beam of length 10 m, which is carrying a point load of 10 KN at a distance 6 m from the left end. **07**

Take E = 2×10^5 N/mm^2 and I = 1×10^8 mm^4.

(B) Derive the equation of torsion, $\frac{T}{J} = \frac{C\theta}{L} = \frac{fs}{r}$ 05

Que. – 5 Attempt following question:

(A) Describe in brief possibility of failure of rivets with neat sketches. 05

(B) Describe in brief for "polar moment of inertia" & "torsional moment of resistance. 04

(C) Differentiate a thin walled cylinder and thick wall cylinder. 03

Que. – 6 Attempt following question:

(A) A steel strut has a solid circular cross section and 2 m long. It is free at the top and fix at bottom and having 6 cm dia. Take factor of safety as 3, Calculate safe load using 06

i. Rankine's formula, Take fc = 550 N/mm^2 and a = 1/1600

ii. Euler's formula, take E = 2 X 10^5 N/mm^2

(B) Solve the equation of circumferential and longitudinal stresses in thin walled sphere 05

OR

Que. – 6 Attempt following question:

(A) Prove the Euler's buckling load equations for "Both ends are fixed". 05

(B) A cylinder is 300 mm mean diameter and 1000 mm long with a wall 4mm thick. It has an internal pressure 2 MPa greater than the outside pressure. Take E = 200 GPa and μ= 0.3 Calculate the following. 06

i. The circumferential stress.

ii. The longitudinal stress.

iii. The change in diameter

iv. The change in length.

v. The change in volume.

---END OF PAPER---

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