Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: 3rd Mechatronics 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 if necessary.

Section - I

Que. – 1 Attempt following question:

(A) Compare the flexural strength of three beams of equal weight with following conditions: (i) rectangular section having b = d/2, (ii) circular section with diameter d, and (iii) I-section with b= d/2, flange thickness = 0.15b and web thickness = 0.1b. **06**

(B) A T-beam is simply supported having 3 m long and a point load of 100kN at mid span. Flange & Web thicknesses are 100mm. Flange and Web are 500mm and 300mm long respectively. Overall depth of T-section is 400mm. Draw shear stress distribution diagram across the section at point of maximum shear force, including values at all important points. **06**

OR

Que. – 1 Attempt following question:

(A) The average shear stress at a section of a simply supported beam having a cross-section of 80mm × 200mm depth is 0.5N/mm^2. Determine: (i) The shear force in the section (ii) The maximum shear stress in the section (iii) Shear stress at a point on a section located at 40mm above N.A. **06**

(B) A composite beam is made up of two timber joists, each 120mm wide and 360mm deep with a steel plate 25mm thick and 300mm deep, placed symmetrically about x-x axis of cross-section firmly fixed between them. Determine the maximum resisting moment of the composite section, if maximum stress in timber is limited to 9MPa. Also find a maximum centrally applied load which the beam can carry on simply supported beam over a span of 4m. Take m =25 and modulus of elasticity for steel is 200kN/mm^2 and for timber it is 8.4 N/mm^2. **06**

Que. – 2 Attempt following question:

(A) At a point in a strained material the stresses acting are shown in figure 1. Find principal stresses. **05**

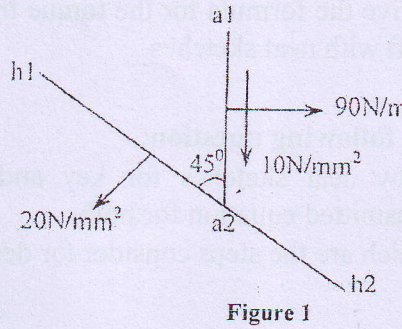

Figure 1

(B) A short column of external diameter and internal diameter carries an eccentric load 'p'. Find the maximum eccentricity of the load that cannot produce tension in the cross section.

OR

Que. – 2 Attempt following question:

(A) A hollow rectangular column of external depth 1m and external width 0.8m is 10 cm thick. Calculate the maximum and minimum stress in the section of the column if the vertical load 200kN is acting with an eccentricity of 15cm in a plane bisecting the width. **05**

(B) A body is subjected to direct stresses in two mutually perpendicular direction accompanied by a simple shear stress. Draw a mohr's circle of stresses and explain how will you obtain the principal stresses and principal planes. **06**

Que. – 3 Attempt following question:

(A) Differentiate between Bending Moment and Moment of Resistance. **02**

(B) Prove that the shear stress at any point (or in a fiber) in the cross-section of a beam which is subjected to a shear force F, is given by $\tau = F \times \frac{A\bar{y}}{b \times I}$. **05**

Where, A = Area of the section above the fiber

$\bar{y}$ = Distance of the C.G. of the area A from N.A.,

b = Actual width at the fiber, and

I = Moment of inertia of the section about N.A.

(C) Define following term : **05**

i. Principal Stress ii. Principal Strain

iii. Flitched Beam iv. Modular Ratio

v. Neutral Axis

Section – II

Que. – 4 Attempt following question:

(A) A beam of uniform rectangular section 100 mm wide and 240 mm deep is simply supported ends. It carries a uniformly distributed load of 9.125 KN/m run over the entire span of' 4m. Find the deflection at the Centre if $E = 1.1 \times 10^4$ N/mm^2. **06**

(B) A steel shaft 1.35 m long, having a diameter of 40 mm is subjected to a uniform toque T. a) For the torque T= 340 Nm find the maximum shear stress in the bar and angle of twist between the ends of the bar. b) If allowable shear stress is 40 N/mm^2 and the allowable angle is 2.5° find the max. Permissible torque. Take $C = 8 \times 10^4$ N/mm^2. **06**

OR

Que. – 4 Attempt following question:

(A) What is a Macaulay's method? Where is it used? What are the rules for this method? Find an expression for deflection of a simply supported beam with an eccentric point load, using Macaulay's method. **06**

(B) Derive the formula for the torque transmitted by a solid shaft and hollow shaft with neat sketches. **06**

Que. – 5 Attempt following question:

(A) Draw neat sketches for key and shaft coupling, note down torque transmitted equation for both. **06**

(B) Which are the steps consider for design of riveted joint? Explain in brief. **06**

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Que. – 6 Attempt following question:

(A) A sphere is 50 mm mean diameter with a wall 0.5mm thick. It has an inside pressure 0.5MPa greater than the outside pressure. Calculate the change in diameter and change in volume. Take E = 212GPa and μ= 0.25 **06**

(B) Prove the equation for Rankine's buckling load for all type of column. **05**

OR

Que. – 6 Attempt following question:

(A) Determine Euler's crippling load for T section 12 cm X 12 cm X 2 cm and 6m long which is used as a struts with both ends hinged. Take E = 2 X 10^5N/mm^2 **05**

(B) Solve hoop and longitudinal stresses in thin walled cylinder with neat sketches. **06**

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