Student Exam No._____

# GANPAT UNIVERSITY

## B. Tech. Semester: 3rd Civil Engineering

## Regular Examination November – December 2014

## 2CI302 – MECHANICS OF STRUCTURES

**Time:** 3 Hours / As per Scheme **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) A Short hollow pier of 1.2m square section outside and 1m square section inside is subjected to a direct load of 120kN along its outer edge point. Determine the final stresses at the base of the pier. Draw neat sketch of stress distribution diagram. **05**

(B) The Principal stresses at a point in a strained material are 45MPa, both are Like Stresses. Find normal, tangential and resultant stresses on plane inclined at $45^0$ with principal planes using answer check with analytical and graphical method. **06**

**OR**

**Que. – 1 Attempt following question:**

(A) Explain "Limit of Eccentricity" **05**

(B) A rectangular body is subjected to direct stresses in two mutually perpendicular directions accompanied by simple shear stress. Prove that the normal stresses and shear stress on an oblique plane inclined at angle θ with the plane of major direct stress are given by **06**

$$f_n = \frac{f1+f2}{2} + \frac{f1-f2}{2}\cos 2\theta + r\sin 2\theta \quad \text{and} \quad f_t = \frac{f1-f2}{2}\sin 2\theta - r\cos 2\theta$$

**Que. – 2 Attempt following question:**

(A) Draw shape of shear distribution diagram for beams having following cross sections under a shear force 'S'. **05**
(a) Rectangular and circular shape (b) I-shape (c) channel 'C' shape (d) channel 'U' shape (e) H shape (f) Hollow rectangular shape (g) plus (+) shape (h) Hollow circular shape (i) T shape (j) Inverted Tee (⊥)shape.

(B) An inverted T-shaped cross-section carries a vertical shear force 100 KN. Draw the shear stress distribution diagram across the section. Web is 250 mm long & 10 mm thick. Flange is 150 mm long & 10 mm thick. **07**

**Que. – 3 Attempt following question:**

(A) Prove that relation, $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ **05**

Where, M = Bending moment, I = Moment of Inertia
σ = Bending stress, y = Distance from N.A.
E = Young's modulus, and R = Radius of curvature.

13

(B) An I-section girder, 200 mm wide 300 deep with a flange and web thickness of 20 mm is used as a simply supported beam over a span of 6 m. The girder carries a uniformly distributed load of 42 KN and a concentrated load of 23 KN at mid span. Determine (a) moment of inertia of the cross-section of the girder and (b) the maximum stress set-up. 07

**OR**

**Que. – 3 Attempt Following question:**

(A) Compare the moment of resistance of a beam of square cross section of 200 mm × 200 mm when it is placed with its, 06
   (a) Sides horizontal and
   (b) Diagonal horizontal

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

(C) What do you mean by 'simple bending' or 'pure bending' ? What are the assumptions made in the theory of simple bending? 03

**Section – II**

**Que. – 4** Using Method of joint, Find out the force in the all member of truss as shown in Figure 1. 12

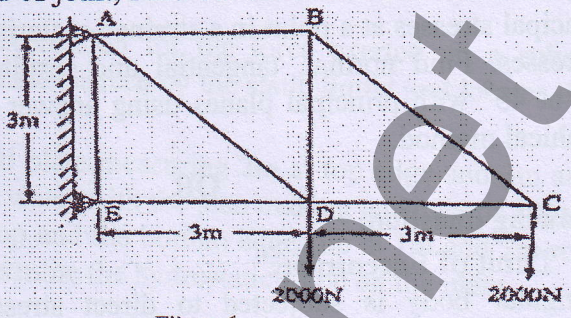


Figure 1

**OR**

**Que. – 4** Using Method of section, Find out the force in the all member of truss as shown in Figure 1. 12

**Que. – 5 Attempt Following question:**

(A) Derive an Expression for Torsional Equation: {T/J =q/r =Gθ/L} 05

(B) Calculate the wall thickness required for a thin walled cylinder which must withstand a pressure difference of 1.5MPa between the inside and outside. The mean diameter is 200 mm and the stress must not exceed 60MPa. 06

**Que. – 6 Attempt any two questions.**

(A) A shaft 40 mm diameter is made from steel and the maximum allowable shear stress for the material is 50MPa.Calculate the maximum torque that can be safely transmitted. 06

(B) Derive an Expression for Direct Stress and Pure Bending. 06

(C) Derive an expression for crippling load for column whose both ends are hinged. 06

---END OF PAPER---