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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech III Semester End Examinations (Regular) - December, 2017

Regulation: IARE – R16

## THEORY OF STRUCTURES

(Aeronautical Engineering)

**Time: 3 Hours**

**Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

### UNIT – I

1. (a) Explain shear force conventions in a beam with neat sketches. [7M]  
 (b) Find the maximum shear stress induced in solid circular shaft of diameter 15cm when shaft transmits 150kW power at 180 rpm. [7M]
2. Define torsional rigidity? Draw shear force and bending moment diagram for the cantilever beam of length L carrying a point load W at its free end. [14M]

### UNIT – II

3. (a) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8m. What UDL per meter beam may carry if the bending stress not exceed  $120 \text{ N/mm}^2$ . [7M]  
 (b) A beam is square section of side 'a', if the permissible bending stress ' $\sigma$ '. Find moment of resistances when beam section is placed such that two sides are horizontal. [7M]
4. A circular beam of 100mm diameter is subjected to shear force of 5 kN. Calculate [14M]
  - (i) Average shear stress
  - (ii) max. Shear stress
  - (iii) shear stress at a position of 40mm from neutral axis.

### UNIT – III

5. (a) Derive the slope and deflection at tip of cantilever beam for carrying UDL of 'w' per meter over a span of 'L', using moment area method. [7M]  
 (b) A beam of length 6m is simply supported at its ends and carries two point loads 48kN and 40kN at a distance of 1m and 3m respectively from left support. Given  $E=200\text{GPa}$ ,  $I=85 \times 10^6 \text{ mm}^4$ . Find deflection under 48kN load and 40kN load using Macaulay method. [7M]
6. (a) Derive the expression for crippling load when both the ends of the column are hinged. [7M]  
 (b) External and internal diameters of hollow cast iron column are 5 cm and 4 cm respectively. If length of this column is 3m and both of its ends are fixed, determine crippling load using Rankines formula. Take  $c=550\text{N/mm}^2$  and  $=1/1600$  in Rankines formula [7M]

### UNIT – IV

7. Determine the forces in truss as shown in Figure 1 which carries a horizontal load of 12kN and a vertical load of 18kN. [14M]

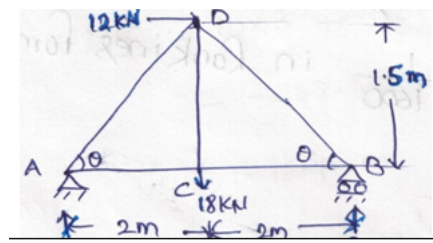


Figure 1

8. (a) Distinguish statically determinate and redundant structures. [7M]  
(b) Define order of redundancy. [7M]

### UNIT – V

9. Derive equilibrium equations for 3 dimensional solid body subjected to external forces. [14M]  
10. Derive an expression for normal and tangential stresses on a oblique plane of a rectangular member when it is subjected to two directive stresses perpendicular to each other. Also determine an angle of obliquity. [14M]

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