Code No: 5115B

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech I Semester Examinations, February - 2017

ADVANCED MECHANICS OF SOLIDS

(Machine Design)

Time: 3hrs **Max. Marks: 60**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 8 marks and may have a, b, c as sub questions.

PART - A

5 × 4 Marks = 20

1.a) Illustrate the location of shear center of different open section beams. [4]
b) Write the various assumptions used in the Winkler-Bach theory. [4]
c) How is torsion of a non circular shaft different from that of circular shaft? [4]
d) What are the assumptions used in a circular plate loaded symmetrically with respect to the central axis. [4]
e) Briefly explain the importance of contact stresses in the machine elements. [4]

PART - B

5 × 8 Marks = 40

2. Locate the shear center for the beam cross section shown in figure 1. The walls of the cross section have constant thickness of 2 mm. [8]

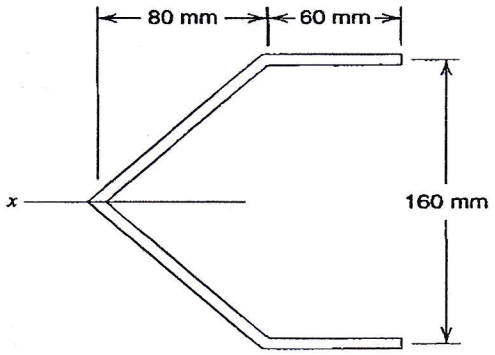

Figure: 1

OR

3. A simply supported beam of length 1.8m carries a central load of 3.4kN inclined at 30^0 to the vertical and passing through the centroid of the section as shown in figure 2. Estimate the maximum tensile stress and maximum compressive stress. [8]

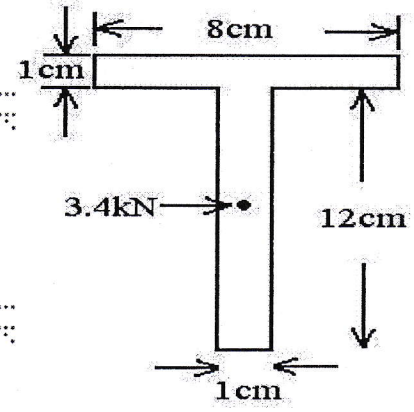

Figure: 2

4. A closed ring of mean radius of curvature 90mm is subjected to a pull of 3kN. The line of action of the load passes through the centre of the ring. Calculate the maximum tensile and compressive stresses in the material of the ring if the ring is circular in cross-section with diameter equal to 15mm. [8]

OR

5. A crane hook whose horizontal cross-section is trapezium, 50mm wide at the inner side, 25mm wide at the outer side and 50mm thick, carries a load of 10kN whose line if action is 60 mm from the inside edge of the section. The centre of curvature is at a distance of 50 mm from the inside edge. Estimate the maximum tensile and compressive stresses developed in the hook material. [8]

6. A thin walled box section has two components as shown in figure 3. It has a constant wall thickness 't', what is the shear stress for a given torque and what is the stiffness, i.e., the torque per unit radian? Derive all the necessary relations for solving the problem starting from fundamentals. [8]

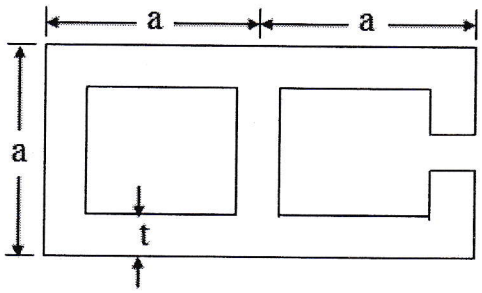

Figure: 3

OR

7. A flat steel turbine disk of 650 mm outside diameter and 100 mm inside diameter rotates at 3600 rpm, at which speed the blade and shrouding cause a tensile rim loading of 4,300 kPa. The maximum stress at this speed is to be 1,04,026 kPa. Find the maximum shrink allowance on the diameter when the disk and the shaft are rotating. [8]

8. Analyze a circular plate freely supported around the edge and having a central hole carrying distributed load. Obtain maximum deflection and moment. [8]

OR

9. A rail road uses steel rails (E =200GPa) with a depth of 184 mm. The distance from the top of the rail to its centroid is 9.91mm, and the moment of inertia of the rail is 36.9×10^6 mm^4. The rail is supported by ties, ballast and a road bed that together are assumed to act as an elastic foundation with spring constant K = 14 N/ mm^2. Determine the maximum deflection, maximum bending moment and maximum flexural stress in the rail for a single wheel load of 170kN. [8]

10. What is contact stress? Discuss the method of computing contact stresses. [8]

OR

11. Derive the expression for contact pressure on a single row ball bearing. If the ball diameter is 40 mm, the radius of the groove is 25 mm. The diameter of the outer race is 200 mm and the greatest compressive force on one ball is 5 kN. Compute the contact pressure. [8]

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