Code No: 113AC **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December - 2016
MECHANICS OF SOLIDS
(Common to ME, MCT, MMT, AE, AME, MSNT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Define proof stress. [2]
b) Define factor of safety and its importance. [3]
c) What do you mean by point of inflection? [2]
d) What is the meaning of strength of a section? [3]
e) Define section modulus and its importance? [2]
f) What is meant by pure bending? What are the assumptions made in theory of pure bending? [3]
g) What do you understand by the term Theories of failure? [2]
h) What is Mohr's circle? How is it useful in the solution of stress analysis problem? [3]
i) What do you mean by equivalent torque? [2]
j) Distinguish between circumferential stress and longitudinal stress? [3]

PART – B

(50 Marks)

2.a) Prove that the maximum stress induced in a body due to suddenly applied load is twice the stress induced when the same load is applied gradually?
b) A bar of 30 mm. dia. is tested in tension under a load of 60 kN. The extension measured over a length of 250 mm is 0.21 mm and construction in diameter is 0.008 mm. Find Poisson's ratio and elastic constants, E and G (Modulus of elasticity and modulus of rigidity). [5+5]

OR

3.a) Define modular ratio, thermal stress, thermal strain and Poisson's ratio.
b) A steel rod 5 cm diameter and 6 m long is connected to two grips and the rod is maintained at a temperature of 100^0C. Determine the stress and exerted when the temperature falls to 20^0C if i) the ends do not yield ii) the ends yield by 0.15 cm. Take $E = 2 \times 10^5$ N/mm^2 and $\alpha = 12 \times 10^{-6}/^0$C. [5+5]

4. A simply supported beam of length 8 m rests on supports 6 m apart, the right hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1500 N/m over the entire length. Draw S.F and B.M diagrams and find the point of contra flexure, if any. [10]

OR

5. A beam of length 12 m is simply supported and carries point load of 3 kN at a distance of 3 m, and 5 kN at a distance of 7 m from left support and also a uniformly distributed load of 3 kN/m between the point loads. Draw the S.F and B.M diagrams for the beam. [10]

6.a) What do you understand by neutral axis and moment of resistance?

b) A beam of I-section is having overall depth as 500 mm and overall width as 190 mm. The thickness of flanges is 25 mm where as the thickness of the web is 15 mm. The moment of inertia about N-A is given as 6.45×10^8 mm^4. If the section carries a shear force of 40 kN. Calculate the maximum shear stress. Also sketch the shear stress distribution across the section. [5+5]

OR

7.a) Prove that the maximum shear stresses in a circular section of a beam is 4/3 times the average shear stress?

b) A beam of a T-section is used as a cantilever with flange at top. The flange is 130 mm wide × 25 mm deep and web is 20 mm wide and 130 mm deep is 2m long. Determine the maximum permissible load which may be suspended from the free end of the cantilever if the limiting stresses in tension and compression are 90 N/mm^2 and 150 N/mm^2 respectively. [5+5]

8.a) Define and explain the following theories of failure.
i) Maximum principal stress theory
ii) Maximum Principal strain theory

b) The normal stresses in two mutually perpendicular directions are 620 N/mm^2 and 310 N/mm^2 both tensile. The complimentary shear stresses in these directions are of intensity 400 N/mm^2. Find the normal and tangential stresses on the two planes which are equally inclined to the planes carrying the normal stresses mentioned above. [5+5]

OR

9.a) Write a note on Mohr's circle of stresses.

b) The principal stresses at a point in an elastic material are 22 N/mm^2 (tensile), 110 N/mm^2 (tensile), and 55 N/mm^2 (Compressive), If the elastic limit in simple tension is 220 N/mm^2 and $\mu = 0.3$. Determine whether the failure of material will occur or not according to the i) Maximum shear stress theory ii) Maximum strain energy theory. [5+5]

10.a) Explain briefly about the effect of internal pressure on the dimensions of a thin cylindrical shell.

b) Find the maximum shear stress induced in a solid circular shaft of diameter 20 cm when the shaft transmits 187.5 kW at 200 rpm. [5+5]

OR

11.a) Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. What are the assumptions made in the derivation?

b) A water main 90 cm diameter contains water at a pressure head of 110 m. If the weight density of the water is 9810 N/mm^3. Find the thickness of the metal required for the water main. Given the Permissible stress as 22 N/mm^2. [5+5]

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