Code No: 153BE **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, September/October - 2023
MECHANICS OF SOLIDS
(Common to ME, MCT, MIE)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Draw the stress strain diagram for mild steel and indicate salient points.	[2]
b)	Distinguish between impact load and suddenly applied load.	[3]
c)	Sketch any 2 types of supports used for a beam indicating the reactions in each case.	[2]
d)	Draw the S.F. & B.M. diagrams for simply supported beam of length L carrying a point load W at its middle point.	[3]
e)	Define the term polar modulus.	[2]
f)	What are the advantages and applications of I-Section?	[3]
g)	What is maximum principal stress theory?	[2]
h)	What is the importance of Von Misses Theory?	[3]
i)	Define circumferential and longitudinal stress.	[2]
j)	What do you mean by equivalent torque?	[3]

PART – B

(50 Marks)

2.a) Define Factor of safety. What is the procedure for finding the thermal stresses in a composite bar?

b) A specimen of steel 22 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 85 kN and the load at elastic limit is 105 kN. The maximum load is 160 kN. The total extension at fracture is 59 mm and diameter at neck is 19 mm. Analyze the behavior of steel specimen and
Calculate:
i) Stress at elastic limit.
ii) Young's modulus.
iii) Percentage elongation.
iv) Percentage reduction in area.
v) Ultimate tensile stress. [5+5]

OR

3.a) What is principle of super-position? Write the relationship between bulk modulus, rigidity modulus and Poisson's ratio.

b) A hollow cylinder 2.5 m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa. [5+5]

4.a) Derive an expression for shear force and bending moment of a simply supported beam carrying a UDL of w/metre length throughout its span with neat sketch.

b) Cantilever beam of 1.4 m length carries a uniformly distributed load of 1.5 kN/m over its entire length. Draw S.F. and B.M. diagrams for the cantilever. [5+5]

OR

5.a) A simply supported beam of 3 m span carries two loads of 5 kN each at 1 m and 2 m from the left hand support. Draw the shear force and bending moment diagrams for the beam.

b) A cantilever beam of length 2 m carries a uniformly distributed load of 2 kN/m over the whole length and a point load of 3 kN at the free end. Construct the S.F and B.M diagrams for the beam. [5+5]

6.a) Prove that shear stress at any point in the rectangular cross-section of a beam which is subjected to a shear force F, given by $\tau = AFy/bI$.

b) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 what uniformly distributed load per metre the beam may carry, if the bending stress is not to exceed 120 N/mm^2. [5+5]

OR

7.a) State the assumptions made in theory of simple bending. Draw the bending stress and shear stress profiles for a hollow circular beam section.

b) An I-sections, with rectangular ends, has the following dimensions: Flanges =150 mm × 20 mm, Web = 300 mm × 10 mm. Find the maximum shearing stress developed in the beam for a shear force of 50 kN. [5+5]

8.a) Discuss the important points from theories of failures used in design.

b) A point is subjected to tensile stresses of 200 MPa and 150 MPa on two mutually perpendicular planes and an anticlockwise shear stress of 30 MPa. Determine by any method the values of normal and shear stresses on a plane inclined at 60^0 with the minor tensile stress. [5+5]

OR

9.a) Develop the expression for normal and tangential stress on a oblique plane when a member is subjected to a simple shear stress q.

b) At a point in a strained material, the principal stresses are 100 MPa and 50 MPa both tensile. Identify the normal and shear stresses at a section inclined at 30^0 with the axis of the major principal stress. [5+5]

10.a) Deduce an expression for the angle of twist in the case of a member of circular cross section subjected torsional moment?

b) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. Also sketch the radial pressure and hoop stress distribution across the section. [5+5]

OR

11.a) Show that the volumetric strain of a cylindrical shell is the sum of longitudinal strain and twice of hoop strain?

b) A solid shaft of 80 mm diameter is to be replaced by a hollow shaft of external diameter 100 mm. Determine the internal diameter of the hollow shaft if the same power is to be transmitted by both the shafts at the same angular velocity and shear stress. [5+5]

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