Printed Page:-04 **Subject Code:- AME0403**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2024 - 2025)

Subject: Strength of Materials

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. The ratio of shear stress to shear strain is called. [CO1, K1] 1

(a) Poisson's ratio

(b) Bulk modulus

(c) Modulus of rigidity

(d) Modulus of elasticity.

1-b. For the bars of composite section. [CO1, K1] 1

(a) The extension in different materials is different

(b) The total external load is equal to the total sum of the loads carried by different materials

(c) Strain in all materials is equal

(d) both (c) and (d).

1-c. The value of equivalent bending moment for a solid circular shaft if it is subjected to both bending and torsion- [CO2, K1] 1

(a) (M+T)/2

(b) $(M^2+T^2)/2$

(c) $[M+(M^2+T^2)1/2]/2$

(d) None of the above

1-d. Torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress (τ) is equal to- [CO2, K1] 1

.

(a) ππD2/16

(b) ππD3/16

(c) ππD2/32

(d) ππD3/32

1-e. In a leaf spring, maximum bending stress developed in the plates is [CO3, K1] 1

(a) wl/nbt^2

(b) $2wl/nbt^2$

(c) $3wl/nbt^2$

(d) $3wl/2nbt^2$

1-f. A loaded column fails due to. [CO3, K1] 1

(a) Stress due to direct load

(b) Stress due to bending

(c) Both (a) and (b)

(d) None of the above.

1-g. The hoop or circumferential stress in a thin cylindrical shell of diameter (D), length (L) and thickness (t), when subjected to an internal pressure (p) is equal to- [CO4, K2] 1

(a) pD/4t

(b) pD/2t

(c) 2pD/t

(d) 4pD/t

1-h. In case of thick cylinders, at any point the three principal stresses, i.e., radial, circumferential and longitudinal [CO4, K1] 1

(a) Are all tensile stresses

(b) Are all compressive stresses

(c) Are all shear stresses

(d) None of the above.

1-i. Neutral axis of a beam always coincides with [CO5, K1] 1

(a) Axis passing through bottom of beam

(b) Axis passing through height h/2 from bottom

(c) Axis passing through height h/3 from bottom

(d) Axis passing through centroid

1-j. The formation of diagonal cracks at junctions is due to _____. [CO5, K1] 1

(a) Shear stress

(b) Bond stress

(c) Temperature stress

(d) Lateral stress

2. Attempt all parts:-

.

2.a.	Define poison ratio. [CO1, K1]	2
2.b.	How Macaulay's method is different from double integration method. [CO2, K2]	2
2.c.	What are the various stresses induced in closed coil helical spring? [CO3, K1]	2
2.d.	What are the criteria for thick cylinder shell? [CO4, K1]	2
2.e.	Explain shear centre. [CO5, K1]	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	A bar of 20 mm diameter is subjected to a pull of 80 kN. The measured extension on gauge length of 250 mm is 0.2 mm and change in diameter is 0.004 mm. Calculate (i) Young's modulus, (ii) Poisson's ratio and (iii) Bulk modulus.[CO1, K3]	6
3-b.	Explain strain energy stored in a member due to axial load application, also derive its expression [CO1, K2]	6
3-c.	A solid circular shaft transmits torque of 3581 Nm. Calculate the shaft diameter, If the twist in the shaft is not to exceed 1 degree in 2 meters length of shaft, and shear stress is limited to 50 MPa. Take G = 100 GPa. [CO2, K3]	6
3-d.	A 400 mm long cantilever beam of rectangular section 60 mm wide and 35 mm deep carries a uniformly varying load. Calculate the value of the w if the maximum deflection in the cantilever is not to exceed 0.65 mm. Take E = 70 GPa. [CO2, K3]	6
3.e.	Write down assumptions and limitations in Euler's theory for column. [CO3, K2]	6
3.f.	Derive the expression for circumferential stress and longitudinal stress for a thin cylindrical shell subjected to an internal pressure. [CO4, K2]	6
3.g.	Derive the expression for 'h^2' for circular section. [CO5, K2]	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	At a point in a bracket the stresses on two mutually perpendicular planes are 400 MPa tensile and 300 MPa tensile. The shear stress across these planes is 200 MPa. Determine the magnitude and directions of principal stresses and maximum shear stress. [CO1, K3]	10
4-b.	A plane element in a body is subjected to a tensile stress of 100 MPa accompanied by a shear stress of 25 MPa. Find (i) the normal and shear stress on a plane inclined at an angle of 20° with the tensile stress and (ii) the maximum shear stress on the plane. [CO1, K3]	10

5. Answer any one of the following:-

5-a.	Write the assumptions for theory of pure bending and also derive the bending equation of beam. [CO2, K2]	10
5-b.	A wooden beam 150 mm wide and 250 mm deep has a span of 4 meters, Determine the load that can be placed at the centre to cause the beam a deflection of 12 mm. Take E = 6*106 KN/m2. Also find the maximum slope. [CO2, K3]	10

6. Answer any one of the following:-

6-a. Derive the expression for Euler's crippling load for a long column when both ends of column are hinged. [CO3, K3] 10

6-b. A solid round bar 60 mm in diameter and 2.5 m long is used as a column. One end of the column is fixed while other end is hinged. Find the safe compressive load for the column using Euler's formula. Assume E = 200 GPa and a factor of safety = 3. [CO3, K3] 10

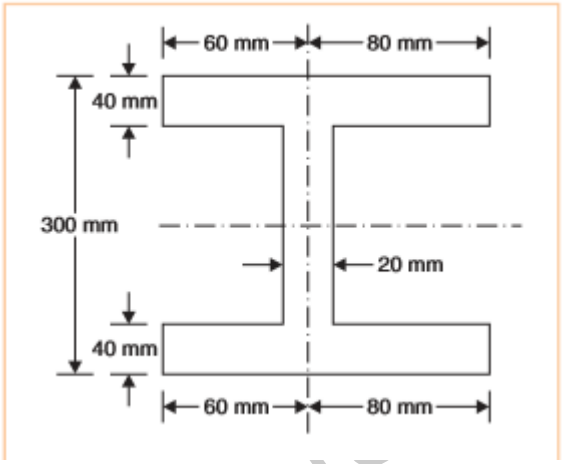
7. Answer any one of the following:-

7-a. A mild steel hollow cylinder has diameter to thickness ratio of 30 MM. Find the internal pressure to which the cylinder should be subjected so that its volume is increased by 4.5×10^4 of its original volume. Take $E = 2 \times 10^5$ and $\mu = 0.3$. [CO4, K3] 10

7-b. A cast iron pipe of 500 mm internal diameter and 200 mm thickness carries water under a pressure of 80 N/mm^2. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. [CO4, K3] 10

8. Answer any one of the following:-

8-a. Determine the position of shear center for the unequal I-section shown in Figure. [CO5, K3] 10



8-b. A hook carries a load of 8 kN and the load line is at a distance of 20 mm from the inner edge of the section which is trapezoidal. The load line also passes through the centre of curvature of the hook. The dimensions of the central horizontal trapezoidal section are: inner width = 25 mm; outer width = 15 mm, depth = 25 mm. Calculate the maximum and minimum stresses.[CO5, K3] 10