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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - CARRY OVER THEORY EXAMINATION - SEPTEMBER 2022

Subject: Strength of Materials

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 mark each & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. 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 Within elastic limit in a loaded material, stress is (CO1) 1

(a) Inversely proportional to strain

(b) Directly proportional to strain

(c) Equal to strain

(d) None of the above

1 The ratio of lateral strain to longitudinal strain is called (CO1) 1

(a) Poisson’s ratio

(b) Bulk modulus

(c) Modulus of rigidity

(d) Modulus of elasticity.

1-c. If a member is subjected to a uniform bending moment (M), the radius of curvature of the deflected form of the member is given by (CO2) 1

(a) M/R=E/I

(b) M/I=E/R

(c) M/I=R/E

(d) M/E=RI

1-d. In the theory of simply bending, the bending stress in the beam section varies (CO2) 1

(a) Linearly

(b) Parabolically

(c) Elliptically

(d) None of them

1-e. When a closely coiled spring is subjected to an axial load, it is said to be under (CO3) 1

(a) Bending

(b) Shear

(c) Torsion

(d) all of these

1-f. Strut is defined as a (CO3) 1

(a) member of a structure which carries a tensile load

(b) Member of a structure which carries an axial compressive load

(c) Vertical member of a structure which carries a tensile load

(d) None of the above.

1-g. A cylindrical vessel is said to be thin if the ratio of its internal diameter to the wall thickness is (CO4) 1

(a) less than 20

(b) equal to 20

(c) more than 20

(d) none of the above.

1-h. The maximum shear stress in a thin cylindrical shell, when subjected to an internal pressure (p) is equal to (CO4) 1

(a) pD/4t

(b) pD/8t

(c) pD/2t

(d) pD/t

1-i. Neutral axis of a beam always coincides with (CO5) 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. If the load passes through the shear center of the section of the beam, then there will be (CO5) 1

(a) No bending of the beam

(b) Only bending of the beam

(c) Bending accompanied by twisting

(d) Only twisting of beam

2. Attempt all parts:-

2.a. What is principal plane?(CO1) 2

2.b. Describe Torsional rigidity (CO2) 2

2.c. What is the difference between thin and thick cylinder? (CO3) 2

2.d. Define-hoop stress & longitudinal stress.(CO4) 2

2.e. Write a short note of deflection of beams in unsymmetrical bending. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Explain strain energy stored in a member due to axial load application, also derive its expression.(CO1) 6

3-b. Explain modulus of elasticity, modulus of rigidity, bulk modulus and poison's ratio.(CO1) 6

3-c. Compare flexural rigidity with torsional rigidity and axial rigidity.(CO2) 6

3-d. Derive the expressions for maximum shear stresses and polar moment of inertia for a hollow shaft of internal diameter d and external diameter D, and a solid shaft of diameter D. (CO2) 6

3.e. State the different applications and structure of semi elliptical/leaf spring.(CO3) 6

3.f. Calculate increase in volume of a spherical shell 1 m in diameter and 1 cm thick when it is subjected to an internal pressure of 1.6 MPa. Take E = 200 GPa and μ= 0.3.(CO4) 6

3.g. Explain principal moment of inertia.(CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. Define and explain the following theories of failure: (CO1) 10

(i) Maximum principal stress theory.

(ii) Maximum shear stress theory.

(iii) Maximum strain energy theory.

4-b. Draw Mohr circle for the given state of stress at a point in a loaded member σx = -85 MPa, 10

σy = 25 MPa, τ xy = 60 MPa. Also find (i) values of maximum and minimum values of normal and shear stress (ii) inclination of major principal plane from (Angle of plane is 45 degrees anticlockwise from vertical axis) (CO1)

5. Answer any one of the following:-

5-a.	Write the assumptions for pure bending and also derive the equation for bending.(CO2)	10
5-b.	Derive the expression for maximum slope and maximum deflection in case of cantilever beam loaded by a uniformly varying load.(CO2)	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)	10
6-b.	Compare the crippling loads given by Rankine's and Rankine's formula for tubular strut of 2.25 m long having outer and inner diameters of 37.5 mm and 32.5 mm loaded through pin joint at both ends. Take yield stress as 315 MPa, a = 1/7500 and E = 200 GPa.(CO3)	10

7. Answer any one of the following:-

7-a.	Differentiate between a thin cylinder and a thick cylinder. Find an expression for the radial pressure and hoop stress at any point in case of a thick cylinder.(CO4)	10
7-b.	Derive the expressions for Lame's equations for radial and circumferential stresses for thick shells.(CO4)	10

8. Answer any one of the following:-

8	Determine the position of shear centre of a channel having dimensions: flanges 120 mm × 20 mm and web 160 mm × 10 mm. (CO5)	10
8	A beam of rectangular section 40 mm × 50 mm has its central line curved to a radius of 60 mm. The beam is subjected to a bending moment of 140 × 103 N-mm. Find the greatest tension and compression stresses in the beam. (CO5)	10