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

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - CARRY OVER THEORY EXAMINATION - APRIL 2023

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 strain energy stored in a body, when the load is gradually applied, is equal to, where σ = Stress in the body E = Modulus of elasticity for the meterial and V = Volume of the body (CO1) 1

(a) (σ2/2E)*V

(b) (σ2/E)*V

(c) (σ2/2V)*E

(d) (σ2/V)*E

1-b. The maximum stress produced in a bar of tapering sections is at (CO1) 1

(a) Larger end

(b) Smaller end

(c) Middle

(d) Anywhere

1-c. The section modulus of a circular section of diameter (d) is (CO2) 1

(a) πd2/32

(b) πd3/32

(c) πd3/64

(d) πd4/64

1-d. The maximum deflection of a cantilever beam carrying a point load at its free end is at the (CO2) 1

(a) Free End

(b) Centre of beam

(c) Slightly away from centre

(d) None of these

1-e. A column of length l is hinged at its both ends. Its equivalent length will be equal to (CO3) 1

(a) 2l

(b) l

(c) 0.5 l

(d) 0.707 l

1-f. The ratio of equivalent lengths for a column of length l whose one end is fixed other kept free to the case when both ends hinged is (CO3) 1

(a) 2

(b) 1

(c) 0.5

(d) 0.707

1-g. The hoop stress in case of thick cylinders across the thickness (CO4) 1

(a) is uniformly distributed

(b) varies from maximum at the outer circumference to minimum at inner circumference

(c) varies from maximum at the inner circumference to minimum at outer circumference

(d) is zero.

1-h. A spherical shell of internal diameter 0.9 m and of thickness 10 mm is subjected to an internal pressure of 1.4 N/mm2. Determine the increase in diameter. Take E = 2 × 105 N/mm2 and μ = 1/3.(CO4) 1

(a) 0.945 mm

(b) 9.0945 mm

(c) 0.00945 mm

(d) 0.0945 mm

1-i. In a fixed beam, temperature variation produces (CO5) 1

(a) Large stresses

(b) Small stresses

(c) Zero stress

(d) None of the above.

1-j. Shear centre may be present (CO5) 1

(a) Inside the body

(b) Outside the body

(c) Both a and b are correct

(d) None of the above

2. Attempt all parts:-

2.a. Explain major principal stress and minor principal stresses. (CO1) 2

2.b. Classify the different types of beams on basis of statically determinate and statically indeterminate beams. (CO2) 2

2.c. What do you understand by the term “buckling” of columns? (CO3) 2

2.d. Distinguish between circumferential stress and longitudinal stress in a cylindrical shell, when subjected to an internal pressure. (CO4) 2

2.e. Give the classification of curved bars. (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. If a weight of 50 N is dropped on to a bar of length 1.5 m and diameter 25 mm. find the maximum normal stress in the bar, elongation of the bar.(CO1) 6

3-b. Derive the expressions for normal stresses induced in the member of cross section area A, due to sudden applied load of W. (CO1) 6

3-c. Describe how Macaulay’s method is used by taking an example of simply supported beam with point load at center. (CO2) 6

3-d. A cantilever 2 m long carries uniformly varying load over the entire length. Find the deflection at the free end if the slope at free end is 2 degrees. (CO2) 6

3.e. Discuss the values of equivalent stiffness of the helical springs when they are connected in series or parallel combinations. (CO3) 6

3.f. A cylindrical boiler shell is to be made of 15 mm thick plate having tensile stress of 120 MPa. If the efficiencies of longitudinal and circumferential joints are 70 percentage and 30 percentage. Determine possible diameter of the shell for an

internal pressure of 2 MPa. (CO4)

3.g. Describe different stresses induced in unsymmetrical beams.(CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. At a point in a material there are normal stresses of 30 N/mm2 and 60 N/mm2 tensile, together with a shearing stress of 22.5 N/mm2. Find the value of principal stresses and the inclination of the principal planes to the direction of the 60 N/mm2 stress.(CO1) 10

4-b. A point is subjected to perpendicular stresses, σx = 50 MPa, and σy = 30 MPa, both tensile. Calculate normal stress, tangential stress and resultant stress and its obliquity on a plane making an angle of 60 degrees with the direction of σx using Mohr's method.(CO1) 10

5. Answer any <u>one</u> of the following:-

5-a. A solid steel shaft has to transmit 75 kW at 200 rpm, taking allowable shear stress as 70 MPa, Find suitable diameter for the shaft if the maximum torque transmitted on each revolution exceeds the mean by 30 percentage. (CO2) 10

5-b. A solid circular shaft transmits 85 kW power at 250 rpm. 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 = 110 GPa.(CO2) 10

6. Answer any <u>one</u> of the following:-

6-a. A closed coiled helical spring is to carry a load of 5000 N with a deflection of 50 mm and a maximum shearing stress of 400 N/mm2, if the number of active turns of active coils is 8. Estimate the following: (a). Wire diameter, (b). Mean coil diameter, and (c). Weight of the spring. Assume G = 83000 N/mm2, Specific weight = 7700 kg/m.(CO3) 10

6-b. A closed coil helical spring is made of round steel wire 6.35 mm in diameter. The mean radius of helix is 31.75 mm, no. of active turns are 12, If G = 84.36 GPa. Find the pull required to extend the spring by 25.4 mm and the stress in the wire.(CO3) 10

7. Answer any <u>one</u> of the following:-

7-a. A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MPa. Also calculate increase in length and diameter. Take E = 200 GPa and μ = 0.3. (CO4) 10

7-b. A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15 mm. Calculate longitudinal and circumferential stresses induced and also increase in length and diameter. If it is subjected to an internal pressure of 1.5 MPa. Take E = 210 GPa and μ = 0.25.(CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. Discuss unsymmetrical bending slope of neutral axis and stresses induced.(CO5) 10

8-b. Determine the position of shear center for the unequal I-section shown in Figure. (CO5) 10