Hall Ticket Number:

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CE213 (R20)

B.TECH. DEGREE EXAMINATION, MARCH-2023

Semester III [Second Year] (Regular & Supplementary)

SOLID MECHANICS-II

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define core of a section. CO1
   (b) Define middle fourth rule. CO1
   (c) Draw the kern of a circular section CO1
   (d) Write the expression for extreme stresses in a short column when subjected to eccentric loading. CO2
   (e) Define principal stress. CO2
   (f) Write the expression for strain energy due to shear. CO2
   (g) Give the expressions for maximum shear stress when the object subjected to two-dimensional stress system. CO3
   (h) Write maximum shear strain energy theory. CO3
   (i) Give the criteria for stable equilibrium. CO3
   (j) Write the expression for Euler's buckling load when both ends are fixed. CO4
   (k) Define buckling load. CO4
   (l) State Moment- Area first theorem CO4
   (m) Write the formula for deflection at free end of a cantilever beam subjected to point load at free end. CO4
   (n) Write the formula for deflection at centre of a simply supported beam subjected to point load at centre. CO4

UNIT – I

2. (a) Compute the kern of a solid circular section. (7M) CO1

(b) A short column of hollow circular section carries a compressive load W. the external and internal diameters are D and d respectively and the ratio of D/d is 7/5. Determine the maximum distance of the point of application of the load from the centre of the cross section if no tensile stress is to exist in the material. (7M) CO1

(OR)

3. A close coiled helical spring is subjected to an axial pull of 600 N. The spring is made out of a 16 mm diameter rod and has 12 complete coils each of mean diameter 120 mm. compute (i) shear stress induced in the rod (ii) deflection under the pull (iii) energy stored in the spring during the extension. Take N = 0.85 x 10^5N/mm^2. CO1

UNIT – II

4. A point in a strained material is subjected to two direct tensile stresses 65 MPa (horizontally), 35 MPa (vertically) and accompanied by shear stresses 25 MPa. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane of 45^o to the vertical plane. Check the answer analytically. CO2

(OR)

5. (a) Derive an expression for strain energy stored in an object due to torsion. (7M) CO2
   (b) Derive an expression for strain energy stored in an object due to axial force. (7M) CO2

UNIT – III

6. The load on a bolt consists of an axial pull of 15 kN together with a transverse shear of 7.5 kN. Determine the diameter of the bolt according to (i) maximum shear stress theory (ii) maximum strain energy theory (iii) maximum shear strain energy theory. CO3

(OR)

7. Derive the Euler's buckling load for a long column with one end pinned and one end fixed. Also state the assumptions. CO3

UNIT – IV

8. Derive the expressions for the slope and deflection of a simply supported beam subjected to a uniformly distributed load all over the span using double integration method. CO4

(OR)

9. A simply supported beam of span 6 m carries a point load of 5 kN at a distance of 2 m from the left end. Determine the slope at the left support, deflection under the load and maximum deflection. Take E = 2 x 10^5 N/mm^2 and I = 1 x 10^8 mm^4. CO4

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CE213 (R20)

Hall Ticket Number:

CE213 (R20)

B.TECH. DEGREE EXAMINATION, JUNE-2023

Semester III [Second Year] (Supplementary)

SOLID MECHANICS - II

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define middle third rule. CO1
   (b) What is the kern of a rectangular section? CO1
   (c) What is deflection of a closely coiled helical spring? CO1
   (d) What is the radius of Mohr's circle? CO2
   (e) Find plane of maximum shear stress, if principle planes are known. CO2
   (f) Find the strain energy stored in a member due to bending moment. CO2
   (g) Find maximum shear stress, If principle stress are known. CO2
   (h) Write the Eulers's buckling load for a column with one end hinged and other end fixed. CO3
   (i) State maximum normal stress theory. CO3
   (j) What is equivalent length of column, if both ends are fixed? CO3
   (k) Write the slope at supports and maximum deflection for simply supported beam subjected to point at its centre. CO4
   (l) State second moment of area theorem. CO4
   (m) Define conjugate beam. CO4
   (n) Write the Secant formula. CO3

UNIT – I

2. A hollow rectangular column of external dimensions 2.4 m x 1.8 m and internal dimensions 1.20 m x 1.20 m. Determine the safe load that can be placed at an eccentricity of 0.5 m on a plane bisecting the longer side. If the maximum compressive stress is not to exceed 5 N/mm^2. Also find minimum stress. CO1

(OR)

3. A helical spring is made of 4 mm diameter wire and mean diameter of the coil being 20 mm. Find what axial load may be applied and the corresponding deflection of spring, if the maximum shear stress is not to exceed 300 N/mm^2 and C = 80 MN/m^2. There are 8 coils in the spring. CO1

UNIT – II

4. At a point in a strained material is subjected to tensile stresses of 100 N/mm^2on one plane and a tensile stress of 50 N/mm^2on a plane right angles, together with the shear stresses of 60 N/mm^2on the same plane. Find (i) Principle planes (ii) Principle stresses (iii) Planes of maximum shear stress and (iv) maximum shear stresses. CO2

(OR)

5. A beam of length 'L' simply supported at the ends is loaded with a point load W at a distance 'a' from one end. Assuming that the beam has constant cross section with moment of inertia as 'I' and Young's modulus of elasticity for the material of the beam as 'E'. Find the strain energy stored and find the deflection under the load. CO2

UNIT – III

6. (a) Explain shear strain energy theory. (7M) CO3

(b) In a steel member at a point the major principle stress is 200 N/mm^2, and the minor principle stress is compressive. If the tensile yield point of the steel is 250 N/mm^2, find the value of the minor principle stress at which yielding will commence, according maximum shear stress theory. (7M) CO3

(OR)

7. (a) Write assumption in Eulers's theory. Derive Euler's buckling load for a long column one end fixed other end free. (7M) CO3

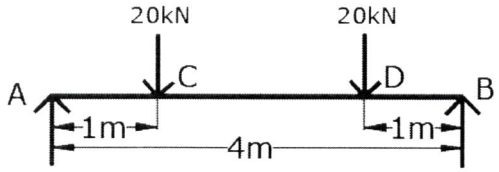
(b) Determine the ratio of buckling strength of solid steel column to that of a hollow column of internal diameter equal to 3/4 of its external diameter. Both columns have same cross sectional areas, length and end conditions. (7M) CO3

UNIT – IV

8. A cantilever of uniform section is loaded with 20 kN at its free end. In addition to this, a UDL of 10 kN/m run is provided over entire span. Determine maximum deflection and slope. The cantilever is 3 m long, 10 cm wide and 30 cm deep. Take E = 210 GN/m^2. CO4

(OR)

9. A simply supported beam shown in figure. Using conjugate beam method, determine the following: (i) Slope at the end A (ii) deflection at C (iii) Maximum deflection. Take : EI = 13000 kN-m^2 CO4



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Hall Ticket Number:

CE213 (R20)

B.TECH. DEGREE EXAMINATION, DECEMBER-2023

Semester III [Second Year] (Regular & Supplementary)

SOLID MECHANICS - II

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define principle of super position. CO1
   (b) Find the kern of a circular section. CO1
   (c) Define spring constant. CO1
   (d) Find the stress in a closely coiled helical spring. CO2
   (e) Find the strain energy stored in a member due to shear. CO2
   (f) Find the stress in a member, if the load is applied suddenly. CO2
   (g) Define principle planes and principle stresses. CO2
   (h) What is maximum shear stress, if σ_x, σ_y are normal stresses along X, Y directions and τ_{xy} is the shear stress on that planes. CO2
   (i) State maximum shear stress theory. CO3
   (j) Define buckling load of a column. CO3
   (k) Define equivalent length of a column. CO3
   (l) What is the maximum deflection of a simple supported beam subjected to uniformly distributed load throughout its length? CO4
   (m) Define conjugate beam. CO4
   (n) Write the governing differential equation for deflection of elastic beam in usual notation. CO4

UNIT – I

2. (a) Explain middle third rule for a dam section. (6M) CO1

(b) A short hollow cylindrical column has 300 mm external diameter and 250 mm internal diameter. It carries a vertical load of 1000 kN, which has an eccentricity by 20 mm. Find the maximum and minimum normal stress induced in the section. (8M) CO1

(OR)

3. (a) Derive the expression for deflection of a closely coiled helical spring. Diameter of the coil is 'd', 'R' is the mean radius of spring and the spring has 'n' no of coils. (7M) CO1

(b) A closely coiled helical spring made of 6 mm diameter is made of 20 coils, each of 100 mm mean diameter. When subjected to axial load of 70 N, find (i) maximum shear stress produced (ii) maximum deflection (7M) CO1

UNIT – II

4. A rectangular block of material is subjected to a tensile stress of 100 N/mm^2 on one plane and tensile stress on 50 N/mm^2 on a plane at right angles together with the shear stresses 60 N/mm^2 on the same planes. Find the normal stress and shear stress on the plane 30^0 with vertical plane and also find principle planes and principle stresses, plane of maximum shear stress and magnitude of maximum shear stress. CO2

(OR)

5. (a) Develop the strain energy stored in a member due to torsion. (7M) CO2

(b) An axial pull of 50 kN is suddenly applied to a steel rod 2 m long and 10 cm^2 in cross-section. Find the strain energy that can be absorbed, if E = 200 GN/m^2. (7M) CO2

UNIT – III

6. (a) Explain maximum strain energy theory. (7M) CO3

(b) A shaft is subjected to maximum torque of 12 kN-m and maximum bending moment of 9 kN-m at a particular section. If the allowable equivalent stress in simple tension is 180 N/mm^2. Find the diameter of the shaft according to maximum shear stress theory. (7M) CO3

(OR)

7. (a) Write assumptions in Eulers's theory. Develop Euler's buckling load for a long column both ends are fixed. (8M) CO3

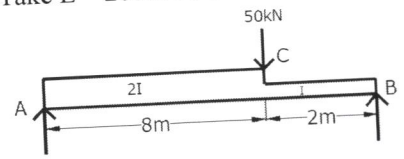
(b) Find Euler's buckling load for a hollow cylindrical cast Iron column, 15 cm external diameter 2 cm thick, If it is 6 m long and hinged at both ends, E = 80 GN/m^2. (6M) CO3

UNIT – IV

8. A beam of uniform section, 10 m long is simply supported at the ends. It carries point loads of 100 kN and 60 kN at distances of 2 m and 5 m respectively from the left end. Determine (i) The deflection under each load (ii) The maximum deflection. Take E = 200 x 10^6 N/mm^2 and I = 118 x 10^{-4} m^4 CO4

(OR)

9. A simply supported beam shown in figure. Using conjugate beam method, determine the following: (i) Slope at the end A (ii) Deflection at C (iii) Maximum deflection. Take E = 200 x 10^6 kN /m^2 and I = 8 x 10^{-5} m^4. CO4



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Hall Ticket Number:

CE213 (R20)

B.TECH. DEGREE EXAMINATION, APRIL-2024

Semester III [Second Year] (Supplementary)

SOLID MECHANICS-II

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) What do you mean superposition of shear stresses? CO1
   (b) Define kernel of a section. CO1
   (c) What are the limitations of superposition? CO1
   (d) What is maximum shear stress? CO2
   (e) Write the strain energy stored in a body due to torsion of shafts. CO2
   (f) What is the significance of Mohr's circle of stress? CO2
   (g) Define buckling of columns. CO3
   (h) Write the Secant formula. CO3
   (i) What is maximum strain energy theory? CO3
   (j) Write the strain-curvature relation. CO4
   (k) What is double integration method? CO4
   (l) List the various methods of evaluation of deflection in beams. CO4
   (m) What do you mean by a conjugate beam? CO4
   (n) State moment area theorem-I and theorem-II. CO4

UNIT – I

2. (a) Derive an expression for kernel of a hollow circular section. (7M) CO1
   (b) A short column of rectangular cross section 450 mm x 600 mm is subjected to an axial load of 400 kN through a bracket with an eccentricity of 50 mm. Determine the maximum and minimum stresses due to this load. (7M) CO1

(OR)

3. (a) A closely coiled helical spring is made by 10 mm diameter steel rod and the coil consisting of 8 turns with a mean diameter of 100 mm. The spring carries an axial pull of 200 N. Calculate the maximum shear stress induced in the steel rod and deflection of the spring. (7M) CO1

   (b) Explain in detail about the superposition of normal stresses and superposition of shear stresses. (7M) CO1

UNIT – II

4. (a) The principal stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60^o to the axis of the major principal stress. Also determine the maximum intensity of shear stress in material at the point. (7M) CO2

   (b) At a point in a bracket the principal stresses are 100 N/mm^2 and 50 N/mm^2 both tensile. Find the principal stresses and maximum shear stress across a plane through the point at 90^o to the major principal plane, using Mohr's circle of stress. (7M) CO2

(OR)

5. (a) A uniform metal bar of rectangular cross section 40 mm x 20 mm is of length 1.5 m. Determine the strain energy stored in a bar when a load of 100 kN is gradually applied on it. If the elastic limit of the bar is made of 160 N/mm^2, what will be the proof resilience and modulus of resilience? (7M) CO2

   (b) Derive an expression for strain energy stored in a body due to shear force. (7M) CO2

UNIT – III

6. (a) Compare maximum normal stress theory and maximum strain energy theory. (7M) CO3

   (b) Derive secant formula for the columns subjected to eccentric loading. (7M) CO3

(OR)

7. (a) Derive Euler's buckling load for a column with one end fixed and other end free. (7M) CO3

   (b) A mild steel tube of 10 m long and 50 mm internal diameter and 3 mm thick is used as a column with both ends fixed. Determine the Euler's buckling load. Take $E = 2 \times 10^5$ N/mm^2. (7M) CO3

UNIT – IV

8. (a) A simply supported beam of span 6 m is subjected to a concentrated load of 45 kN at 2 m from the left support. Calculate the deflection under the load point. Take $E = 2 \times 10^5$ N/mm^2 and $I = 14 \times 10^6$ mm^4. (7M) CO4

   (b) A simply supported beam of uniform flexural rigidity EI and span L carries two symmetrically placed loads P at one-third of the span from each end. Derive the expression for deflection at the middle of the span using moment area method. (7M) CO4

(OR)

9. (a) A beam of length 'L' is simply supported at its ends and carries a point load of 'W' at the centre. The moment of inertia of the beam is '2I' for the left half and "I" for the right half. Using conjugate beam method calculate slope at each end and at the centre. Also, find the deflection at the centre. (7M) CO4

(b) A simply supported beam of span 5 m, carrying a point load of 5 kN at a distance of 3 m from the left end. Find (i) slope at the left support, (ii) deflection under the load and (iii) maximum deflection. Take E = 2 x 10^5 N/mm^2 and I = 1 x 10^8 mm^4. (7M) CO4

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Hall Ticket Number:

CE213 (R20)

B.TECH. DEGREE EXAMINATION, DECEMBER-2024

Semester III [Second Year] (Regular & Supplementary)

SOLID MECHANICS - II

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

(a)	Draw the core of a hollow circular cross section by indicating salient values.	CO1
(b)	Write the strain energy expression in a closed coiled helical spring under axial load.	CO1
(c)	Explain the middle third rule of the dam.	CO1
(d)	Define principal stresses.	CO2
(e)	Explain about Bending Stress.	CO2
(f)	Draw the Mohr's circle for a two dimensional element subjected to only normal stresses.	CO2
(g)	Write the expression to find the distortion energy.	CO3
(h)	What are the limitations of Euler's theory?	CO3
(i)	State the limitations of Secant formula.	CO3
(j)	State the moment area theorem to find the slope in a beam.	CO4
(k)	Draw the moment curvature diagram at a section in a beam.	CO4
(l)	State moment area theorem-II.	CO4
(m)	How the supports change in conjugate beam?	CO4
(n)	Write the differential equation for deflection of the beam.	CO4

UNIT – I

2. (a) A short column of rectangular cross-section 80 mm by 60 mm carries a load of 40 kN at a point 20 mm from the longer side and 35 mm from the shorter side. Determine the maximum compressive and tensile stresses in the section. (7M) CO1

   (b) A closed coiled helical spring of mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 kN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm, take $C = 8 \times 10^4$ N/mm^2. (7M) CO1

(OR)

3. (a) Draw neat sketches of kernel of the following cross-sections: (i) rectangular section 200 mm x 300 mm (ii) Square with 400 cm^2 Area. (7M) CO1

   (b) A short column of external diameter 40 cm and internal diameter 20 cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension on the cross-section. (7M) CO1

UNIT – II

4. The stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major stresses. Also determine the maximum intensity of shear stress in the material at the point. CO2

(OR)

5. At a certain point in a strained material, the intensities of stresses on two planes at right angle to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by a shear stress of magnitude 10 N/mm^2. Find graphically the location of principal planes and evaluate the principal stresses. CO2

UNIT – III

6. (a) Explain briefly about maximum shear stress theory. (7M) CO3

   (b) Derive Euler's crippling load when both the ends of the columns are hinged. (7M) CO3

(OR)

7. (a) Explain briefly about maximum strain energy theory. (7M) CO3

   (b) Derive Euler's crippling load when both the ends of the columns are fixed. (7M) CO3

UNIT – IV

8. A horizontal beam AB of length 2 m is carrying a point load 10 kN at B. The moment of inertia for the right half of the cantilever is 1×10^8 mm^4, whereas that for the left half is 2 times the right half. If $E = 2 \times 10^5$ kN/m^2, find the slope and deflection at the free end of the beam. CO4

(OR)

9. A horizontal beam AB is simply supported at A and B, 6 m apart. The beam is subjected to a clockwise couple of 300 kNm at a distance of 4 m from the left end. If E = 200 GPa and $I = 2 \times 10^8$ mm^4, determine the deflection at the point where the couple is acting and also the maximum deflection. CO4

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