Hall Ticket Number:

CE123 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester II [First Year] (Supplementary)

SOLID MECHANICS - I

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 shear stress.	CO1
(b)	State Hooke's law.	CO1
(c)	Define Bulk modulus of elasticity.	CO1
(d)	What types of stresses induced in thin walled cylindrical pressure vessel?	CO2
(e)	Define factor of safety.	CO1
(f)	Define point of contra flexure.	CO3
(g)	Mentions types of supports for a beam.	CO3
(h)	Write bending equation.	CO4
(i)	State assumptions made in the theory of simple bending.	CO4
(j)	Write flexural formula.	CO4
(k)	Write the formula for power transmitted by solid circular shaft.	CO5
(l)	What is shear flow?	CO4
(m)	Sketch the shear stress distribution in T-section beam.	CO4
(n)	Define torsional rigidity.	CO5

UNIT – I

2. (a) A solid uniform metal bar of diameter D and length L is hanging vertically from its upper end. Obtain the total elongation of the bar due to its own weight if γ is the specific weight and E is the young's modulus of the material of the bar. (7M) CO1

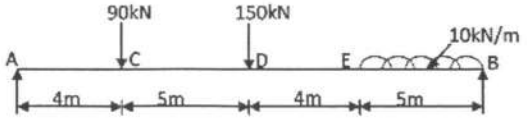
   (b) A rod of steel is 20 m long at a temperature of 20°C. Find the free expansion of the rod when the temperature is raised to 65°C. Find the temperature stress produced (i) when the expansion of the rod is prevented (ii) when the rod is permitted to expand by 5.8 mm. Consider $\alpha = 12 \times 10^{-6}/°C$ and $E = 2 \times 10^5 N/mm^2$. (7M) CO1

(OR)

3. Derive the relationship between Modulus of elasticity, Modulus of rigidity and Bulk modulus. CO1

UNIT – II

4. Draw shear force and bending moment diagrams for the beam shown in figure for the given loading system. CO2



(OR)

5. A beam AB 10 m long has supports at its ends A and B. It carries a point load of 8 kN at 3 m from A and a point load of 5 kN at 7 m from A and a uniformly distributed load of 4 kN/m between the point loads. Draw the SF and BM diagrams for the beam. CO2

UNIT – III

6. (a) A proposed beam of a I section of 10 m, 600 mm deep and 200 mm wide has a flange 20 mm thick and web 15 mm thick. It carries a uniformly distributed load of 80 kN/m over the whole span. Find the extreme bending stress for the section and state if the stress is permissible. Safe stress in bending is 160 N/mm^2. (8M) CO3

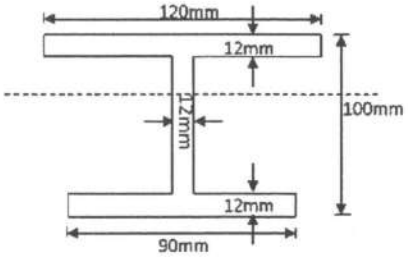
   (b) For the above problem 6 (a) if the stress is not permissible, find the width of a 15 mm thick cover plate for each flange for the section to be safe. Find also the length of this cover plate. (6M) CO3

(OR)

7. Analyze a beam of I section has top and bottom flanges 175 mm x 125 mm and web of size 300 x12 mm. It is used as a simply supported beam over a span of 4 m to carry a uniformly distributed load of 85 kN/m over its entire span. Draw the bending stress at centre of the beam. CO3

UNIT – IV

8. Analyze the beam having a cross-section as shown in figure. If the shear force acting on this is 150 kN, Draw the shear stress distribution diagram across the depth. CO4



(OR)

9. A hollow shaft of diameter ratio 3/5 is to transmit 450 kW at 120 rpm with uniform twisting moment. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m must not exceed 1°. Calculate the minimum external diameter of the shaft satisfying these conditions. Consider modulus of rigidity $C = 8 \times 10^4$ N/mm^2. CO4

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Hall Ticket Number:

CE123 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2024

Semester II [First Year] (Regular)

SOLID MECHANICS-I

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 by 'a bar of uniform strength'? CO1
   (b) Why a uniaxial tensile member fails at a lower stress than at the ultimate stress? CO1
   (c) Name the different elastic constants. Give the relationship among the elastic constants. CO1
   (d) What is point of contraflexure? CO2
   (e) What are the different loading types that generally act on a beam? CO2
   (f) Explain the terms: Sagging bending moment and Hogging bending moment. CO2
   (g) What are the assumptions of beam theory? CO3
   (h) What is the meaning of 'Strength of a section'? CO3
   (i) How would you find the bending stress in unsymmetrical section? CO3
   (j) A rectangular section of a beam is subjected to a bending moment M and a shear force F. Why bending stresses are maximum at extreme layer while shear stress is zero at these layers? CO4
   (k) Sketch the typical variation of shear stress across the depth of I-section, showing the position of maximum shear stress. CO4
   (l) Define torsional rigidity. CO4
   (m) Write the expression for torque transmitted by a solid shaft when subjected to torsion. CO4
   (n) State the assumptions of torsion theory of circular shaft. CO4

UNIT – I

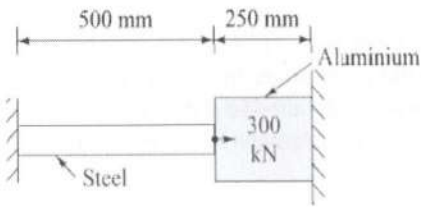
2. (a) From a tensile test, following information is available within elastic limit. A tensile load of 54 kN produces an elongation of 0.112 mm for a specimen with gauge length 300 mm. The initial diameter of the rod specimen was 30 mm and after the application of the load, it gets reduced by 0.00366 mm. Find out Poisson's ratio and values of the three elastic moduli. (7M) CO1

   (b) Draw the stress-strain diagram of a mild steel specimen subjected to tension and explain the salient features. (7M) CO1

(OR)

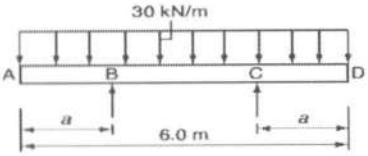
3. (a) A cylindrical pressure vessel has internal diameter 1.2 m and plate thickness of 12 mm. Find out the maximum internal pressure it can sustain so that neither circumferential nor longitudinal nor radial stress exceed 140 MPa. Also find out the maximum internal pressure that a spherical pressure vessel with same external diameter and thickness can withstand. (7M) CO1

   (b) Determine the stresses induced in aluminium and steel portions of the composite bar due to a force of 300 kN applied at the junction as shown in figure. The cross-sectional areas of steel and aluminium are 1250 mm^2 and 2500 mm^2, respectively. Modulus of elasticity of steel and aluminium are 210 GPa and 70 GPa, respectively. (7M) CO1



UNIT – II

4. A beam 6 m long rests on two supports with equal overhangs on either side and carries a uniformly distributed load of 30 kN/m over the entire length of the beam as shown in figure. Calculate the overhangs if the maximum positive and negative bending moments are to be same. Draw the shear force and bending moment diagrams and locate the salient points. CO2



(OR)

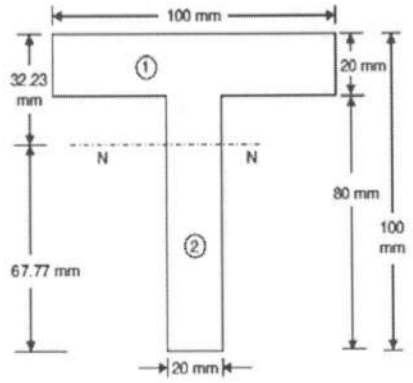
5. A beam ABCDE is 12 m long, simply supported at points B and D. Spans AB = DE = 2 m are overhanging and BC = CD = 4 m. The beam supports a uniformly distributed load of 10 kN/m over AB and 20 kN/m over CD. In addition, it also supports concentrated load of 10 kN at E and a clockwise moment of 16 kNm at point C. Sketch the bending moment and shear force diagrams. CO2

UNIT – III

6. Two circular beams where one is solid of diameter D and other is a hollow of outer diameter D_o and inner diameter D_i, are of the same length, same material and of same weight. Find the ratio of section modulus of these circular beams. CO3

(OR)

7. A cast iron beam is of T-section as shown in figure. The beam is simply supported on a span of 8 m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses. CO3



UNIT – IV

8. A solid steel shaft subjected to a torque of 80 kN-m. If the angle of twist is 6° per meter length of the shaft and the shears stress is not to exceed 100 MPa, find (i) suitable diameter of shaft (ii) final maximum shear stress (iii) maximum shear strain in the shaft. Take G = 80 GPa. CO4

(OR)

9. (a) An I-section beam 350 mm × 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. (7M) CO4

   (b) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine: (7M) CO4

   (i) Average shear stress, Maximum shear stress, and

   (ii) Shear stress at a distance of 25 mm above the neutral axis.

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CE123 (R20)

Hall Ticket Number:

CE123 (R20)

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester II [First Year] (Supplementary)

SOLID MECHANICS-I

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)	Write the expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at the lower end.	CO1
(b)	Define the term: Proportional limit and elastic limit.	CO1
(c)	Explain the term 'shear stress' and 'complimentary stress' with proper illustrations.	CO1
(d)	Discuss the usefulness of shear force and bending moment diagrams.	CO2
(e)	Define statically determinate and statically indeterminate beams. Give examples for each.	CO2
(f)	Draw the S.F. and B.M. diagrams for a cantilever of length L carrying a uniformly distributed load of w per m length over its entire length.	CO2
(g)	In simple bending, plane transverse sections remain plane after bending; explain this assumption with the help of simple sketch.	CO3
(h)	What is neutral layer? Why stress and strain are zero in the neutral layer?	CO3
(i)	Take the case of channel section, explain symmetrical bending and unsymmetrical bending	CO3
(j)	The shear stress is not maximum at the N.A. in case of a triangular section. Prove this statement.	CO4
(k)	Sketch the typical variation of shear stress across the depth of rectangular T-sections, showing the positions of maximum shear stress.	CO4

(l) Define the term 'polar modulus'. CO4

(m) Make a simple sketch of a shaft subjected to twisting moment. Take a small element on the surface of the shaft and mark directions of principal stresses. CO4

(n) Define shear centre. CO4

UNIT – I

2. (a) A compound bar is made of a central steel plate 50 mm wide and 10 mm thick to which copper plates 10 mm wide and 5 mm thick are connected rigidly on each side. The length at the compound bar at room temperature is 1000 mm. If the temperature is raised by 100°C, determine the stress in each material and the change in length of the compound bar. Assume E_{Steel} = 200 GPa, E_{Cu} = 100 GPa, $\alpha_{Steel} = 12 \times 10^{-6}$ /°C, $\alpha_{Cu} = 18 \times 10^{-6}$ /°C. (7M) CO1

(b) Derive an expression for the total extension of the tapered bar of length L and of circular cross section (diameter D and d), when it is subjected to an axial tensile load 'P'. (7M) CO1

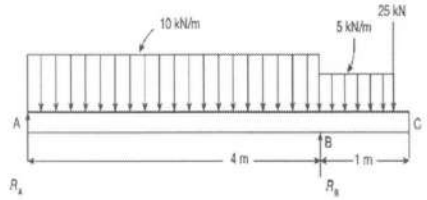
(OR)

3. (a) A steel bar 300 mm long, 50 mm wide and 40 mm thick is subjected to a pull of 300 kN in the direction of its length. Determine the change in volume. Take $E = 2 \times 10^5$ N/mm^2 and $\mu = 0.25$. (7M) CO1

(b) Find the increase in volume of a thin-walled spherical shell, subjected to uniform internal pressure p. Consider the internal radius to be r. (7M) CO1

UNIT – II

4. Draw the shear force and bending moment diagrams of the beam loaded as shown in figure. Also find the point of contraflexure. CO2

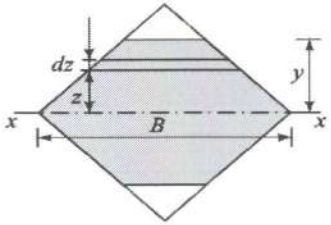


(OR)

5. A simply supported beam AB, 8 m long carrying a point load 3 kN at 2 m from A and a point load 2 kN at 5 m from A and a uniform distributed load of 2 kN/m between the point loads. Determine the position and magnitude of maximum bending moment. Draw the shear force and bending moment diagrams. CO2

UNIT – III

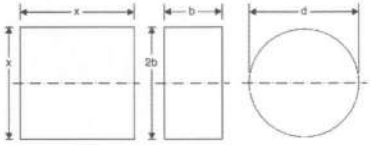
6. (a) Determine the maximum increase possible in moment of resistance of a square beam when bent about its diagonal by cutting its top and bottom edges as shown in figure. (7M) CO3



(b) Prove that relation, $M / I = \sigma / y = E / R$. (7M) CO3

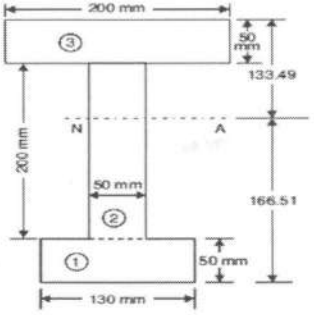
(OR)

7. Three beams have the same length, same allowable bending stress and the same bending moment. The cross-section of the beams are a square, rectangle with depth twice the width and a circle. Find the ratios of weights of the circular and the rectangular beams with respect to square beams. CO3



UNIT – IV

8. The shear force acting on a beam at an I-section with unequal flanges is 50 kN. The section is shown in figure. The moment of inertia of the section about N.A. is 2.849×10^4 mm^4. Calculate the shear stress at the N.A. and also draw the shear stress distribution over the depth of the section. CO4



(OR)

9. A solid circular shaft has a slight taper extending uniformly from one end to the other. The radius at larger end is 1.2 times the radius at smaller end. Find out the error committed, if someone calculates the angle of twist using mean radius of the tapered shaft. CO4

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Hall Ticket Number:

CE123 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

Semester II [First Year] (Supplementary)

SOLID MECHANICS - I

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 shear strain. CO1
   (b) Explain stress-strain diagram for mild steel. CO1
   (c) Define Poisson's ratio. CO2
   (d) Explain about bending moment. CO3
   (e) Explain cantilever beam and its end conditions. CO3
   (f) What is shear force at free end of a cantilever beams with point load at free end? CO3
   (g) Write the assumptions in theory of simple bending. CO4
   (h) Define section modulus. CO4
   (i) What is meant by flexural rigidity? CO4
   (j) Determine the section modulus of rectangular cross section b x d. CO4
   (k) Write the section modulus for solid and hollow circular sections. CO4
   (l) Draw the shear stress distribution for 'T' and 'I' sections. CO4
   (m) Define shear centre. CO4
   (n) What are the assumptions made in the theory of pure torsion? CO5

UNIT – I

2. A tensile load of 50 kN is acting on a rod of diameter 35 mm and of length 6 m. A bore of diameter 25 mm is made centrally on the rod. To what length the rod should be bored so that the total extension will increase 30 % under the same tensile load. Take $E = 2 \times 10^5$ N/mm^2. CO1

(OR)

3. The following data refer to a mild steel specimen tested in a laboratory:
   Diameter of the specimen = 30 mm
   Length of the specimen = 250 mm
   Extension under a load of 15 kN = 0.055 mm
   Load at yield point = 125 kN
   Maximum load = 240 kN
   Length of the specimen after failure = 410 mm
   Neck diameter = 18 mm.
   Determine:
   (i) Young's modulus.
   (ii) Yield point.
   (iii) Ultimate stress.
   (iv) Percentage of elongation.
   (v) Percentage reduction in area.
   (vi) Safe stress adopting a factor of safety of 2. CO2

UNIT – II

4. A cantilever beam of length 2 m carries the point loads 200 N, 400 N and 700 N at distances 0.5 m, 1.2 m and 2 m respectively from the fixed end. Draw the SF and BM diagrams for cantilever beam. CO3

(OR)

5. A beam 6 m long is simply supported at the ends and carries a uniformly distributed load of 15 kN/m and three concentrated loads of 10 kN, 20 kN and 30 kN acting respectively at the left quarter point, centre point and right quarter point. Draw the shear force and bending moment diagrams and determine the maximum bending moment. CO3

UNIT – III

6. A timber beam of rectangular section is to support a load of 40 kN uniformly distributed over a span of 4 m when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed 8 N/mm^2, find the dimensions of the cross section. CO4

(OR)

7. A rolled steel Joist of I-Section has flange length of 300 mm wide and 20 mm thick with a web thickness of 20 mm and overall depth of I-Section is 600 mm. If this beam carries a UDL of 40 kN/m over the simply supported beam of span 10 m, find the maximum stress produced in the beam. CO4

UNIT – IV

8. A simply supported beam of span 4.5 m has a cross-section 150 mm x 250 mm of the permissible stress is 12 N/mm^2. Find out the (i) Maximum intensity of uniformly distributed load it can carry (ii) Maximum concentrated (P) applied at 2 m from one end it can carry. CO4

(OR)

9. (a) Derive the shear stress and deflection of a close coiled helical spring with axial load for a circular section. (7M) CO5
   (b) A helical coil spring is made of round steel wire 6.35 mm in diameter. The mean radius of the helix is 31.75 mm; number of complete turns is 12. The spring is close coiled. If C = 84.36 GN/m^2, then find (i) The pull required to extend the spring by 25.4 mm and (ii) The stress in the wire. (7M) CO5

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Hall Ticket Number:

CE123 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

Semester II [First Year] (Regular & Supplementary)

SOLID MECHANICS-I

Time: Three hours | Maximum Marks: 70

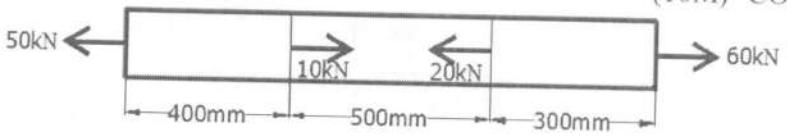
Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Classify the different types stresses. CO1
   (b) Sketch the bar of varying section subjected to axial load. CO1
   (c) Differentiate between Twisting moment and Bending Moment. CO5
   (d) Define yield stress. CO1
   (e) Differentiate between thin and thick cylinder. CO1
   (f) Write the expressions for Hoop Stress and Longitudinal stress in case of thin cylindrical pressure vessel? CO2
   (g) What do you mean by Poisson's ratio? CO1
   (h) Define section modulus. CO4
   (i) What do you mean by principal stress? CO2
   (j) Show the location of neutral axis for a symmetric I-section with help of neat sketch. CO4
   (k) What do you mean by unsymmetric bending? CO4
   (l) What is the difference between zero bending moment and point of contraflexure? CO3
   (m) List the assumptions in bending theory. CO4
   (n) What is shear centre? CO4

UNIT – I

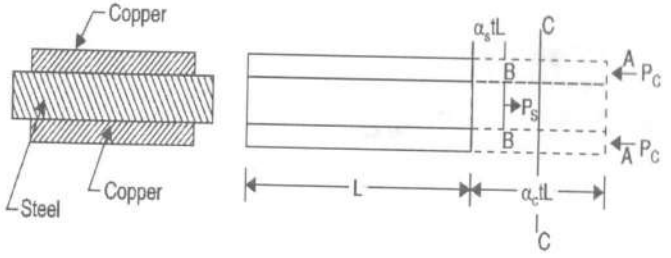
2. (a) Explain the significance of Modulus of Elasticity in assessing the material strength. How do you relate Modulus of elasticity to Bulk modulus? (4M) CO1

(b) Find the maximum stress and total elongation of a bar subjected to loads as shown in figure. The bar has a diameter 30 mm and E for the bar 105 GPa. (10M) CO1



(OR)

3. A compound bar is made of a steel plate 50 mm wide and 10 mm thick to which copper plates of size 40 mm wide and 5 mm thick are connected rigidly on each side as shown in figure. The length of the bar at normal temperature is 1 m. If the temperature is raised by 80°, determine the stresses in each metal and the change in length. Given $\alpha_s = 12 \times 10^{-6}/°C$, $\alpha c = 17 \times 10^{-6}/°C$, $Es = 2 \times 10^5$ N/mm^2, $Ec = 1 \times 10^5$ N/mm^2. CO2

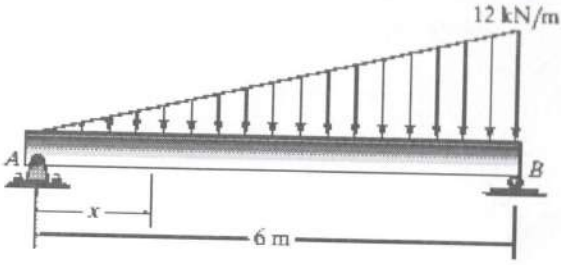


UNIT – II

4. A horizontal beam 10 m long is carrying UDL of 2 kN/m. The beam is supported on two supports 6 m apart. Find the position of supports so that the bending moment as small possible. Also draw the Shear force and Bending moment diagrams. CO3

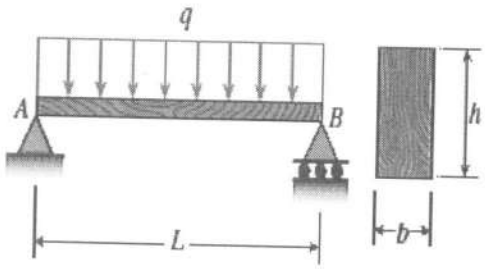
(OR)

5. Determine the reactions at the supports and draw the Shear force & Bending moment diagram for a beam shown in figure. CO3



UNIT – III

6. A simply supported wood beam AB with span length L = 4 m carries a uniform load of intensity q = 5.8 kN/m shown in figure. Calculate the maximum bending stress due to the load 'q' if the beam has a rectangular cross section with width b = 140 mm and height h = 240 mm. CO4

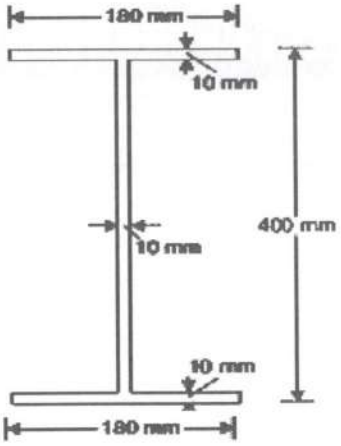


(OR)

7. A simply supported beam of span 10 m having T-section is subjected to a udl of intensity 20 kN/m throughout. Plot the bending stress distribution. Dimensions of T-section are: Flange 100 mm x 20 mm; Web 80 mm x 20 mm. CO4

UNIT – IV

8. Draw the shear stress variation diagram for the I-section shown in figure, if it is subjected to a shear force of 100 kN. CO4



(OR)

9. A shaft has to transmit a power of 6 kW at 200 rpm. Design (i) a solid circular shaft and (ii) a hollow circular shaft with a 1.2 ratio of external to internal diameter. The maximum shear stress is limited to 90 MPa and the angle of twist cannot be more than 30° per metre length. Take G = 85 GPa. CO5

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CE123 (R20)

file-2

Hall Ticket Number:

CE123 (R20)

B.TECH. DEGREE EXAMINATION, JANUARY-2023

Semester II [First Year] (Supplementary)

SOLID MECHANICS - I

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 stress. CO1
   (b) State Hooke's law. CO1
   (c) What is meant by statically indeterminate axially loaded member? CO1
   (d) How do you classify thin pressure vessels? CO2
   (e) Define bulk modulus. CO2
   (f) Mention diagrammatic conventions of beam supports. CO3
   (g) Define (i) Shear force (ii) Bending moment. CO3
   (h) Sketch bending moment diagram for a cantilever of length L subjected to point load P at the free end. CO3
   (i) Differentiate between strength and stiffness. CO4
   (j) State assumptions made in theory of simple bending. CO4
   (k) Define section modulus. CO4
   (l) Distinguish between shear stress and bending stress. CO4
   (m) Define shear centre. CO4
   (n) What is torsional rigidity. CO5

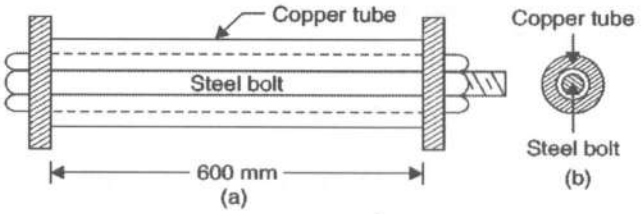
UNIT – I

2. (a) Explain the terms: (4M) CO1
   (i) Factor of safety
   (ii) Poisson's ratio
   (b) Derive the relationship between the three Elastic Moduli. (10M) CO1

(OR)

3. (a) Sketch stress-strain diagram for HYSD steel and indicate the salient points on it. (4M) CO1

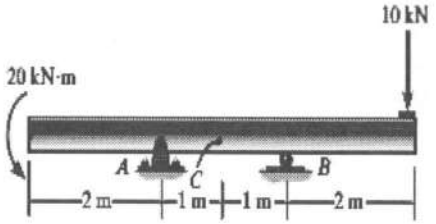
(b) A steel bolt of 20 mm diameter passes centrally through a copper tube of internal diameter 28 mm and external diameter 40 mm as shown in figure. The length of whole assembly is 600 mm. After tight fitting of the assembly, the nut is over tightened by quarter of a turn. What are the stresses induced in the bolt and tube, if pitch of nut is 2 mm? Take $E_s = 2 \times 10^5$ N/mm^2 and $E_c = 1.2 \times 10^5$ N/mm^2. (10M) CO1



UNIT – II

4. (a) Describe the point of contraflexure. What is the significance of it? (4M) CO3

(b) Draw the shear force and bending moment diagrams for a beam shown in figure (10M) CO3



(OR)

5. (a) Derive the relation between bending moment and shear force, shear force and loading. (6M) CO3

(b) A simply supported beam 8 m long is subjected to a u.d.l. of 1 kN/m extending from left end up to the centre of the beam. There is an anticlockwise couple of 10 kN.m acting at a distance of 2.0 m from the right end. Sketch the shear force and bending moment diagram. (8M) CO3

UNIT – III

6. (a) Describe what do you understand by 'the material is homogeneous, isotropic and obeys Hooke's law' which is one of the assumption in theory of simple bending. (4M) CO4

(b) A cast iron beam of I-section with a top flange 80 mm x 20 mm thick, bottom flange 160 mm x 40 mm thick and the web 200 mm deep and 20 mm thick. The beam is freely supported on a span of 5 m. If the tensile stress is not exceeding 20 N/mm^2, find the safe uniformly distributed load the beam can carry. Find also maximum compressive stress. (10M) CO4

(OR)

7. Derive the Bending equation (Flexure formula). CO4

UNIT – IV

8. (a) Draw the shear stress distribution for a beam of Channel section subjected to shear force indicating how it varies at the junctions. (4M) CO4

(b) An I-section has a depth 200 mm, flange width of 120 mm, flange thickness 15 mm and web thickness of 10 mm. The beam is subjected to a shear force 50 kN. Determine the shear stress distribution across the section. Also find % of shear force taken by web. (10M) CO4

(OR)

9. (a) Derive Torsion equation. (7M) CO5

(b) A solid circular shaft transmits 75 kW power at 200 rpm. Estimate the shaft diameter, if the twist in the shaft is not to exceed one degree in 2 m length of shaft and shear strength is not to exceed 50 N/mm^2. Take G = 100 kN/mm^2. (7M) CO5

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CE123 (R20)

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Hall Ticket Number:

CE123(R20)

B.TECH. DEGREE EXAMINATION, OCTOBER-2022

Semester II [First Year] (Regular & Supplementary)

SOLID MECHANICS-I

Time: Three hours

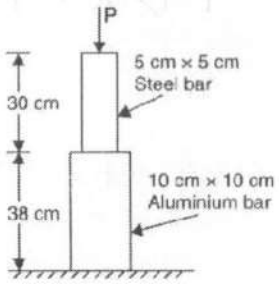
Maximum Marks: 70

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 is elastic limit? CO1
   (b) Define Poisson's ratio. CO1
   (c) How will you find the stresses and load carried by each member of a composite bar? CO1
   (d) Define shear force and bending moment. CO3
   (e) Explain point of contra flexure. CO3
   (f) Draw the types of beams with neat sketches. CO3
   (g) Define neutral axis. CO4
   (h) Define section modulus. CO4
   (i) State the assumptions made in the theory of simple bending. CO4
   (j) Distinguish between thin and thick pressure vessels. CO2
   (k) Draw the shear stress distribution for rectangular section. CO4
   (l) Define shear centre. CO4
   (m) Define Torsion. CO5
   (n) What are the assumptions made in the theory of pure torsion? CO5

UNIT – I

2. A member formed by connecting a steel bar and Aluminium bar is loaded as shown in figure. Calculate the magnitude of load P that will cause the total length of the member to decrease 0.25 mm. Take E for steel and aluminium is 210 GPa and 70 GPa respectively. CO1



(OR)

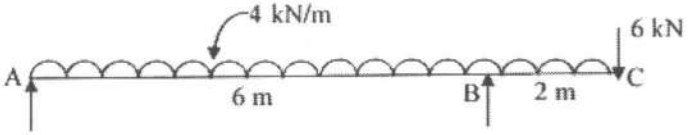
3. A 30 mm aluminum rod 3 m long is subjected to an axial pull of 100 kN. Taking E = 70 GPa and Poisson's ratio 0.3, determine the elongation, change in diameter and volume of the rod. Also, estimate the bulk modulus. CO1

UNIT – II

4. A simply supported beam of length 12 m, carries the uniformly distributed load of 10 kN/m over a length of 4 m starting from 4 m from the left support. Point loads of 50 kN and 40 kN acts at a distance of 4 m and 8 m from the left support. Draw the S.F and B.M diagrams for the beam. Also calculate the maximum bending moment. CO3

(OR)

5. An overhanging beam is shown in figure. Draw the Shear force and Bending moment diagrams. CO3



UNIT – III

6. (a) Derive the bending equation for pure bending. (7M) CO4
   (b) A simple beam carries a U.D.L of 15 kN/m (including self weight) over its entire span of 4 m. If the permissible stresses for timber are

12 MPa in compression, 10 MPa in tension and 0.8 MPa in shear, design a suitable rectangular beam. Take the width of rectangular beam as one third of the depth. (7M) CO4

(OR)

7. A timber beam of rectangular section is to support a load of 30 kN uniformly distributed over a span of 4 m when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed 8 N/mm^2, find the dimensions of the cross section. CO4

UNIT – IV

8. (a) Derive the relation between average shear stress and the maximum shear stress for a rectangular section and draw the shear distribution diagram. (7M) CO4
   (b) A timber beam 150 mm x 250 mm in cross section is simply supported at its ends and has a span of 3.5 m. The maximum safe allowable stress in bending is 7500 kN/m^2. Find the maximum safe U.D.L. which the beam can carry. What is the maximum shear stress in the beam for the U.D.L. calculated? (7M) CO4

(OR)

9. (a) A solid shaft of 200 mm diameter has the same cross section area as that of the hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of the power transmitted by the two shafts at the same speed. (7M) CO5
   (b) If a solid shaft of 100 mm diameter transmits 110 kW at 200 rpm then, find the maximum intensity of shear stress induced and the angle of twist for a length of 6 m.
   Take C = 8 x 10^4 N/mm^2. (7M) CO5

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Hall Ticket Number:

CE123(R20)

B.TECH. DEGREE EXAMINATION, FEBRUARY-2022

Semester II [First Year] (Supplementary)

SOLID MECHANICS-I

Time: Three hours | Maximum Marks: 70

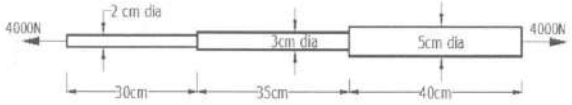
Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define stress. CO1
   (b) What is the principle of super position? CO1
   (c) What is the relation between Young's modulus and rigidity modulus? CO1
   (d) Define Poisson's ratio. CO1
   (e) Find the bending moment for simply supported beam subjected to uniformly distributed load throughout its length. CO3
   (f) What is the relation between bending moment and shear force? CO3
   (g) Draw the sketch of any two types of beams. CO3
   (h) What is section modulus of a rectangular section? CO4
   (i) Define bending stress. CO4
   (j) Define shear stress CO4
   (k) What is the expression for power transmitted by shaft? CO5
   (l) Define bending moment. CO3
   (m) What is torsion equation? CO5
   (n) What is the maximum shear stress in rectangular section? CO4

UNIT – I

2. (a) Develop an expression for relation between modulus of Elasticity and Bulk modulus. (6M) CO1

   (b) An axial pull of 4000 N is acting on a bar consisting of three lengths as shown in figure, if the Young's modulus of the material of the rod is 2×10^5 N/mm^2 , determine stress in each section and total extension in bar. (8M) CO1



(OR)

3. (a) Explain stress-strain curve for mild steel. (8M) CO1

   (b) A cylindrical pipe of diameter 2.5 m and thickness 2.5 cm is subjected to an internal fluid pressure of 1.4 N/mm^2. Determine circumferential stress and longitudinal stress developed in the pipe. (6M) CO1

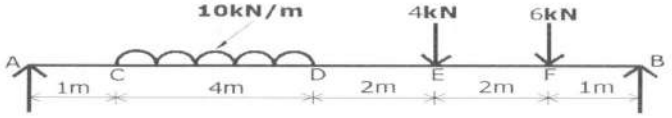
UNIT – II

4. (a) Develop the differential equations of equilibrium for a beam element. (7M) CO3

   (b) Draw the shear force and bending moment diagrams for a cantilever of span 3 m, with a UDL of 10 kN/m on the entire span. (7M) CO3

(OR)

5. Draw shear force and bending moment diagram for the beam shown in figure. CO3



UNIT – III

6. Write the assumptions in theory of simple bending and derive the bending equation. CO4

(OR)

7. A beam of I section has top and bottom flanges 150 mm x 25 mm and web of size 300 mm x 12 mm. It is used as a simply supported beam over a span of 4 m to carry an uniformly distributed load of 80 kN/m over its entire span. Calculate the maximum stress due to bending and sketch the bending stress distribution diagram. CO4

UNIT – IV

8. Develop the expression for the shear stress at a section in a loaded beam. CO4

(OR)

9. (a) A rectangular beam 100 mm wide and 150 mm deep is subjected to a shear force of 30 kN. Determine maximum shear stress and average shear stress. (6M) CO4

   (b) A hollow shaft of external diameter 130 mm transmits 400 kW power at 300 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 80 N/mm^2. (8M) CO5

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Hall Ticket Number:

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CE123(R20)

B.TECH. DEGREE EXAMINATION, OCTOBER-2021

Semester II [First Year] (Regular)

SOLID MECHANICS-I

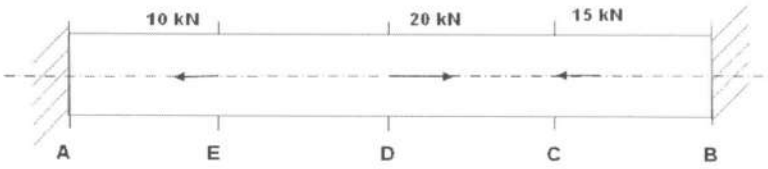
Time: Three hours | Maximum Marks: 70

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

1. Answer the following:
   (a) Distinguish between 'True Stress-Strain Curve' and 'Engineer's Stress-Strain Curve'. CO1
   (b) State Hooke's law. CO1
   (c) What is the relationship between the modulus of elasticity and modulus of rigidity? CO1
   (d) Why the radial stress is neglected in a thin cylinder? CO2
   (e) What are the stress resultants in a beam? CO3
   (f) Define 'point of inflexion'. CO3
   (g) Sketch the bending moment diagram for a cantilever beam of length L subjected to point load P at the free end. CO3
   (h) Define section modulus. CO4
   (i) State the assumptions made in deriving bending equation. CO4
   (j) Define neutral axis. CO4
   (k) Write the equation for power transmitted by circular shaft. CO5
   (l) Sketch the shear stress distribution across T-section of a beam. CO4
   (m) Explain the term 'shear center'. CO4
   (n) Define torsional rigidity. CO5

UNIT – I

2. A prismatic copper bar of 2 m long is supported by rigid supports at ends A and B. Axial forces 10 kN, 20 kN and 15 kN are applied at E, D and C respectively as shown in figure. Find the displacement of section at C, D and E. Young's modulus of copper is 110 GPa. The segments AE, ED, DC and CB are of same length. The cross-sectional area of copper bar is 250 mm^2. CO1



(OR)

3. A thin cylindrical shell of 800 mm inner diameter, 10 mm wall thickness and 3 m long with closed ends, is subjected to an internal fluid pressure of 3 MPa. Determine the change in inner diameter, change in length and change in storage capacity of the cylindrical shell. Young's modulus and Poisson's ratio of shell material are 200 GPa and 0.25 respectively. CO2

UNIT – II

4. A prismatic beam AEDCB is supported by a hinge at left end A and a roller at C. It is subjected to a concentrated load of 100 kN at E and a couple of 30 kN-m clockwise at D in addition to the 20 kN/m uniformly distributed load on the overhang CB. Draw the shear force and bending moment diagrams by indicating all salient values. AE = 2 m, ED = 1.5 m, DC = 1.5 m and CB = 2 m. CO3

(OR)

5. A prismatic concrete pole of length 'L' and self-weight of 'w' per unit run, has to be lifted with a crane by placing one crane hook at left end and the other crane hook at 'a' distance from right end. The pole remains horizontal during the lift. Find the value of 'a' so that the maximum bending moment is as small as possible. Draw the shear force and bending moment diagrams by indicating all salient values. CO3

UNIT – III

6. The cross section of a beam is symmetrical I-section consisting of 200 mm x 50 mm flanges and 50 mm x 300 mm web. The allowable stress in bending is 120 MPa. Determine the moment of resistance of the beam cross section. Find the magnitude of compressive and tensile forces on the cross section of beam. Also find the location of these forces on the cross section of beam. CO4

(OR)

7. The cross section of a 2 m long cast iron beam consists of 150 mm x 25 mm top flange, 25 mm x 225 mm web and 250 mm x 50 mm bottom flange. The allowable bending stresses are 100 MPa in compression and 25 MPa in tension. Determine the safe load on the beam when it is used as CO4
   (i) Cantilever beam subjected to uniformly distributed load over the entire span.
   (ii) Simply supported beam subjected to uniformly distributed load over the entire span.

UNIT – IV

8. A simply supported beam of 4 m span carries 8 kN/m uniformly distributed load over the entire span. The cross section of a beam is symmetrical I-section consisting of 250 mm x 50 mm flanges and 50 mm x 300 mm web. Draw the variation of flexural shear stress on cross section of beam at critical section by indicating all salient values. CO4

(OR)

9. A circular shaft transmits 300 kW power at 120 rpm. The allowable shear stress of shaft material is 70 MPa. The maximum torque in the shaft exceeds its mean value by 15%. Determine the required diameter of solid circular shaft. If this solid circular shaft is replaced with a hollow circular shaft of same material having the inner diameter as two-thirds of its outer diameter, find the required diameter of a hollow circular shaft. What is the percentage saving of material? Compare the torsional stiffness and torsional rigidity of the above two shafts. CO5

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