



SIDDHARTH INSTITUTE OF ENGINEERING TECHNOLOGY :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: STRENGTH OF MATERIALS(18CE0151)

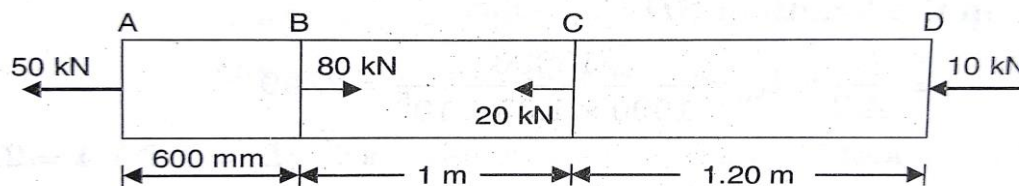
Branches: ME&AG

Year & Sem: II-B.Tech-Sem

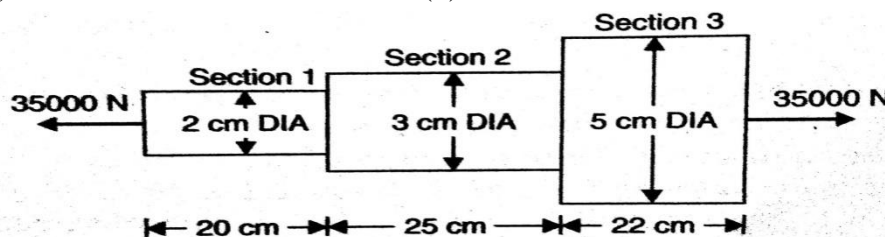
Regulation: R18

UNIT – I

1. (a) Define elasticity and plasticity? 2M
 (b) State Hooke's law with equation? 2M
 (c) Define the terms Factor of Safety and Poisson's ratio? 2M
 (d) What is the difference between Resilience and Proof Resilience? 2M
 (e) What are the practical applications of impact loads? 2M
2. a. Define stress and strain and Explain their types. 5M
 b. A circular rod of diameter 20 mm and 500 mm long is subjected to a tensile force of 45 KN. the modulus of elasticity for the material is $2.1 \times 10^5 \text{ N/mm}^2$. Find the stress, strain & the elongation of circular rod. 5M
3. a. Explain briefly about the stress strain diagram for mild steel. 5M
 b. A brass bar, having cross-sectional area of 1000 mm^2 , is subjected to axial forces as shown in figure. Find the total elongation of the bar. Take $E = 1.05 \times 10^5 \text{ N/mm}^2$ 5M



4. An axial pull of 35000 N is acting on a bar consisting of three lengths as shown in figure. If the Young's modulus is taken as $2.1 \times 10^5 \text{ N/mm}^2$, Determine: 10M
 (i) Stresses in each section and (ii) Total extension of the bar.



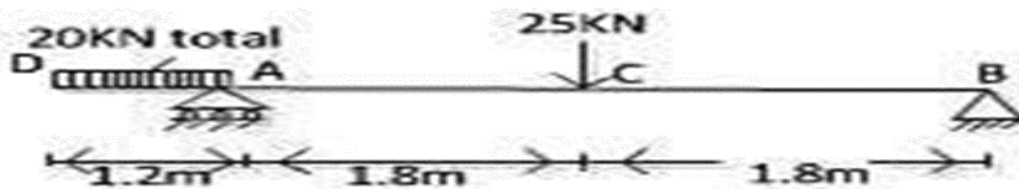
5. A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm. the composite bar is then subjected to an axial pull of 45000 N. if the length of each bar is equal to 15 cm, determine: i) The stresses in the rod and tube, and (ii) Load carried by each bar 10M
6. A steel rod of 3 cm diameter and 5 m long is connected to two grips and the rod is maintained at temperature of 95°C . Determine the stress and pull exerted when the temperature falls to 30°C , if 10M

(i) The ends do not yield, and (ii) The ends yield by 0.12 cm. Take $E=2 \times 10^5 \text{N/mm}^2$ and $\alpha=12 \times 10^{-6}/^\circ\text{C}$

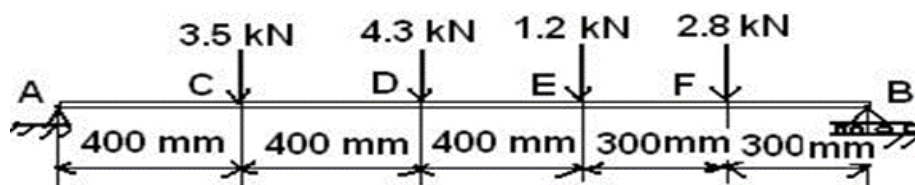
7. Determine the changes in length, breadth and thickness of a steel bar which is 4 m long, 30 mm wide and 20 mm thick and is subjected to axial pull of 30 KN in the direction of its length. Take $E=2 \times 10^5 \text{N/mm}^2$ and $\mu=0.3$ 10M
8. a. A steel bar 300 mm long, 50 mm wide and 40 mm thick is subjected to a pull of 300 KN in the direction of its length. Determine the change in volume Take $E=2 \times 10^5 \text{N/mm}^2$ and $\mu=0.25$. 5M
- b. Define the following terms 5M
 (i) Elasticity & Plasticity (ii) Hooke's law & factor of safety (iii) Lateral & longitudinal strains
9. Define Strain energy & resilience. A tensile load of 60 KN is gradually applied to a circular bar of 4 cm diameter and 5 m long if $E=2 \times 10^5 \text{N/mm}^2$. Determine: i) stretch in the rod (ii) stress in the rod and (iii) strain energy absorbed by the rod 10M
10. a. Define Bulk Modulus. Calculate the Bulk modulus for a material having young's modulus $1.2 \times 10^5 \text{N/mm}^2$ and $\mu=1/4$. 5M
- b. A bar of 30mm diameter is subjected to a pull of 60 KN. The measured extension on gauge length of 200 mm is 0.1mm and change in diameter is 0.004 mm, calculate: 5M
 (i) Young's modulus (ii) Poisson's Ratio and (iii) bulk modulus.

UNIT-II

- 1 (a) What are the types of supports? 2M
 (b) Write the classification of beams? 2M
 (c) Explain the different types of loads with diagrams 2M
 (d) What is the difference between simply supported beam and cantilever beam? 2M
 (e) What is the use of SFD and BMD? 2M
- 2 A cantilever of length 3 m carries a uniformly distributed load of 2.5 KN/m lengths over 10M
 the whole length and a point of 3.5 KN at the free end. Draw SFD and BMD for the
 cantilever
- 3 A simply supported beam of length 8 m carries point load of 4 KN and 7 KN at 10M
 distances 3 m and 6 m from the left end. Draw SFD and BMD for the beam.
- 4 A cantilever of length 3 m carries a uniformly distributed load of 1.5 KN/m run over a 10M
 length of 2 m from the free end. Draw SFD and BMD for the beam
- 5 Simply supported beam of length 6 m carries a uniformly increasing load of 600 N/m at 10M
 one end to 1500 N/m run at the other end. Draw SFD and BMD for the beam. And also
 calculate the position and magnitude of maximum bending moment.
- 6 Draw the SFD and BMD for the cantilever beam carrying uniformly distributed load of 10M
 whole length and also derive an equation for it
- 7 Draw the shear force and bending moment diagrams for the beam shown in the figure. 10M



- 8 a Draw the S.F and B.M diagram for a cantilever beam of span 'L' m loaded with UDL of 5M
 W KN/m.
- b Draw the shearing force and bending moment diagrams for the beam shown in figure. 5M



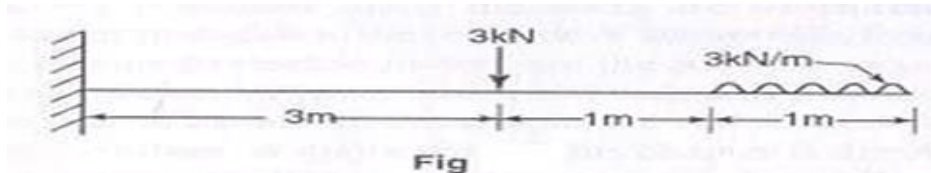
- 9 a Define beam. Sketch different types of beams, types of supports and types of loads 5M
 indicating their names.
- b Draw the S.F and B.M diagram for a S.S.B of span 'L' m loaded with UDL of W KN/m. 5M
- 10 Draw the shear force and bending moment diagram for a simply supported beam AB of 10M
 span 9 meters carrying a uniformly distributed load of 18 KN per meter for a distance of
 4 meters from the left support A.

UNIT-III

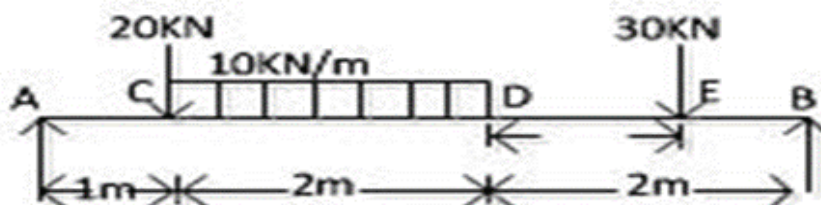
- 1 (a) Define bending and shear stress 2M
 (b) What is the meaning of strength of section? 2M
 (c) What is neutral layer and neutral axis? 2M
 (d) What is the theory of simple bending? 2M
 (e) What are the assumptions made in theory of simple bending? 2M
- 2 Derive the bending equation 10M
- 3 A beam of cross – section of an isosceles triangle is subjected to a shear force of 45 KN 10M
 at a section where base width = 125 mm and height = 400 mm. Determine:
 (i) Horizontal shear stress at the neutral axis.
 (ii) The distance from the top to the beam where shear stress is maximum and
 (iii) Value of maximum shear stress.
- 4 Derive the formula for shear stress at a section 10M
- 5 A timber beam of rectangular section is to support a load of 30 k N uniformly 10M
 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/mm², find the
 dimensions of the cross section
- 6 A steel beam of I –section, 200 mm deep and 160 mm wide has 16 mm thick flanges 10M
 and 10 mm thick web. The beam is subjected to a shear force of 200 KN. Determine the
 shear stress distribution over the beam section.
- 7 A simply supported beam carries a uniformly distributed load of intensity 30 N/mm 10M
 over the entire span of 2 m. The cross section of beam is a T-section having flange 125
 x 25 mm and web 175 x 25 mm. Calculate the maximum shear stress for the section
 subjected to maximum shear force. Also draw the shear stress distribution
- 8 a Define section modulus. Write the units for section modulus. Derive the section 5M
 modulus for hollow circular cross section
- b A timber beam 120 mm wide and 200 mm deep is simply supported over a span of 4 m. 5M
 The beam carries a UDL of 2.8 KN/m over the entire length. Find the maximum
 bending stress induced. Plot the bending stress distribution at the quarter span cross
 section of the beam.
- 10 A beam is simply supported and carries a uniformly distributed load of 40KN/m run 10M
 over the whole span. The section of the beam is rectangular having depth as 500mm. If
 the maximum stress in the material of the beam is 120 N/mm² and moment of inertia of
 the section is $7 \times 10^8 \text{mm}^4$, find the span of the beam.

UNIT IV

- 1 a) What is deflection of beam? 2M
 b) What causes deflection of beam? 2M
 c) How do you control beam deflection?? 2M
 d) What is torsion of circular shaft? 2M
 e) Define polar modulus? 2M
- 2 Derive the relation between slope, deflection and radius of curvature 10M
- 3 Determine: (i) slope at the left support, (ii) deflection under the load and (iii) maximum deflection of a simply supported beam of length 6 m, which is carrying a point load of 5 KN at a distance of 2 m from the left end. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 1 \times 10^8 \text{ mm}^4$. 10M
- 4 A beam of length 8 m is simply supported at its ends and carries two-point loads of 36 KN and 46 KN at a distance of 1.5 m and 4 m from the left support. Find: (i) deflection under each load. (ii) Maximum deflection and (iii) The point at which maximum deflection occurs, given $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 85 \times 10^6 \text{ mm}^4$. Use Macaulay's method.? 10M
- 5 A cantilever of length 4 m carries a uniformly distributed load 3 KN/m over a length of 1.5 m from the free end and a point load of 2 KN at the free end. Find the slope and deflection at the free end if $E = 2.1 \times 10^5 \text{ N/mm}^2$ and $I = 6.667 \times 10^7 \text{ mm}^4$.? 10M
- 6 Find the slope and deflection at the free end of the cantilever shown in figure. 10M
 Take $EI = 1 \times 10^{10} \text{ kN-mm}^2$



- 7 Determine the deflections at points C, D and E in the beam shown in the figure. Take $E = 200 \text{ kN/mm}^2$ and $I = 60 \times 10^6 \text{ mm}^4$ 10M



- 8 A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. 10M
 Determine the maximum internal diameter if the maximum stress in the shaft is not exceeded to 60 N/mm^2 .
- 9 Derive an expression for Torque transmitted by a hollow circular shaft 10M

- 10** A composite shaft consists of steel rod 60 mm diameter surrounded by a closely fitting tube of brass. Find the outside diameter of the tube so that when a torque of 1000N-m is applied to the composite shaft, it will be shared equally by the two materials. Take C for steel 8.4×10^4 N/mm² and C for brass 4.2×10^4 N/mm². Find also the maximum shear stress in each material and common angle of twist in a length of 4 m. 10M

UNIT-V

- 1 (a) Define thin cylinder and thick cylinder? 2M
 (b) What is thin walled pressure vessel? 2M
 (c) Define circumferential and longitudinal stress? 2M
 (d) How do you measure internal pressure in a tank? 2M
 (e) Why is pressure vessel cylindrical? 2M
- 2 A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If 10M
 the drum is subjected to an internal pressure of 2.5 N/mm^2 , determine (i) change in diameter (ii) change in length and (iii) change in volume. Take $E = 2 \times 10^5 \text{ N/mm}^2$ Poisson's ratio 0.25.
- 3 A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made of 10M
 steel plate 3 mm thick. The length and the internal diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 3 N/mm^2 . Also calculate the increase in length, diameter and volume of the vessel. Take E as $2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio 0.3.
- 4 A copper cylinder, 90 cm long, 40 cm external diameter and wall thickness 6 mm has its 10M
 both ends closed by rigid blank flanges. It is initially full of oil at atmospheric pressure. Calculate additional volume of oil which must be pumped into it in order to raise the oil pressure to 5 N/mm^2 above atmospheric pressure. For copper assume $E = 1.0 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio $1/3$. Take bulk modulus of oil as $K = 2.6 \times 10^3 \text{ N/mm}^2$.
- 5 A cast iron pipe 200 mm internal diameter and 12 mm thick is wound closely with a 10M
 single layer of circular steel wire of 5 mm diameter, under a tension of 60 N/mm^2 . Find the initial compressive stress in the pipe section. Also find the stresses set up in the pipe and steel wire, when water under a pressure of 3.5 N/mm^2 is admitted in to the pipe. Take $E = 1 \times 10^5 \text{ N/mm}^2$ for cast iron and for steel $E = 2 \times 10^5 \text{ N/mm}^2$. Poisson's ratio is given as 0.3.
- 6 Derive the formula for longitudinal and circumferential stresses 10M
- 7 Determine the maximum and minimum hoop stress across the section of a pipe of 400 10M
 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2 . Also sketch the radial pressure and hoop stress distribution across the section.
- 8 A compound tube is composed of a tube 250 mm internal diameter and 25 mm thick 10M
 Shrunk on a tube of 250 mm external diameter and 25 mm thick. The radial pressure at the junction is 8 N/mm^2 . The compound tube is subjected to an internal pressure of 84.5 N/mm^2 . Find the variation of the hoop stress over the wall of the compound tube.
- 9 A steel tube of 200 mm external diameter is to be shrunk on to another steel tube of 60 10M
 mm internal diameter. After shrinking the diameter at the junction is 120 mm. Before shrinking on the difference of diameter at the junction is 0.08 mm. Find the hoop

stresses developed in the two tubes after shrinking on and the radial pressure at the junction. Take $E = 2 \times 10^5 \text{ N/mm}^2$.

- 10** Derive the expression for stresses developed in a compound thick cylinder (Lame's theorem). 10M