SIDDHARTH INSTITUTE OF ENGINEERING &TECHNOLOGY:: PUTTUR

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QUESTION BANK

Subject with Code: Strength of Materials(16CE104) Course& Branch: B. Tech - CE Year &Sem : II-B. Tech &I-Sem Regulation: R16

UNIT – I

1 An axial pull of 35000N is acting on a bar consisting of three different lengths
i) L=20 cm and d=2cm ii) L=25 cm and d=3 cm iii) L=22 cm and d=5 cm (10M)
If the young's modulus =$2.1x10^5$ $N/mm^{2,}$ Determine stresses in each section and total extension of bar.

2 A compound tube consists of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two tubes are of same length. The compound tube carries an axial load of 900 KN. Find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 140 mm. The E for steel as $2x10^5$ N/mm^2 and for brass as $1x10^5$ N/mm^2. (10M)

3 a) Derive the relation between E and C. (4M)

b) A bar of 30mm diameter is subjected to a pull of 60KN. The measurement extension on guage length of 200mm is 0.1mm and change in diameter is 0.004mm. Calculate E, poisons ratio and K. (6M)

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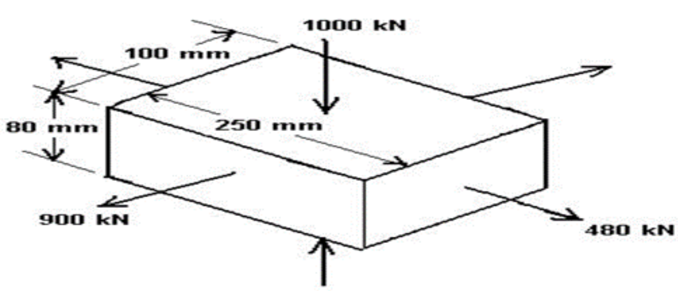
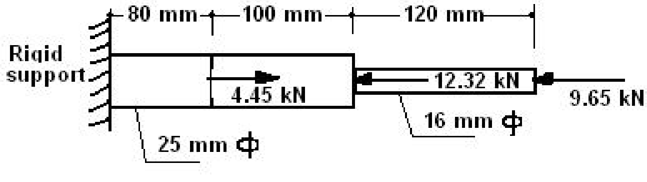
5 A uniform metal bar has a cross sectional area of 700 mm^2 and a length of 1.5 m. If the stress at the elastic limit is 160 N/mm^2 , what will be its proof resilience. Determine also the maximum value of an applied load , which may be suddenly applied without exceeding the elastic limit. Calculate the value of the gradually applied load which will produce the same extension as that produced by suddenly applied load above. (10M)



6 Derive the relation between the three elastic constants E,C and K (10M)

7 A rectangular block 250 x 100 x 80 mm is subjected to axial loads as shown in figure. Assuming Poisson's ratio as 0.25, find the strains in the direction of each force. Find the modulus of rigidity, bulk modulus of the material and change in volume of the block. Take $E_s = 2.0 \times 10^5$ N/mm^2. (10M)

8 a) A circular stepped bar carries a series of loads as shown in figure. Compute the stress in each segment of the bar. All loads act along the central axis of the bar. (7M)



Bar carrying axial loads

b) Define stress and strain and specify the units for both. Write two examples for each of the ductile material and brittile material. (3M)

9 A steel rod of 20mm dia causes centrally through a copper tube of 50mm external dia and 40 mm internal dia. The tube is closed at each end by rigid plates of negligible thickness. The nuits are tightened lightly home on the projecting parts the rod. If the temp of assembly is raised by 50^0c cal the stresses developed in copper and steel. Take E for steel and copper as 200 GPa and 100 GPa and co.of linear expansion for steel and copper $12X10^{-6}\,{}^0C$ and $18X10^{-6}\,{}^0C$. (10M)

10 Define the following terms (10M)
- A) Stress & strains
- B) Elasticity & Plasticity
- C) hooks law & factor of safety
- D) Lateral & longitudinal strains
- E) Strain energy & resilience

UNIT – II

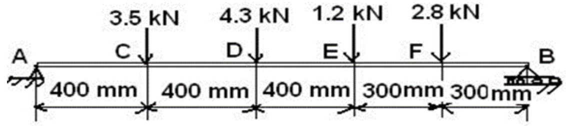
1 A cantilever of length 3 m carries a uniformly distributed load of 2.5 kN/m length over the whole length and a point of 3.5 KN at the free end. Draw SFD and BMD for the cantilever. (10M)

2 A simply supported beam of length 8 m carries point load of 4 KN and 7 KN at distances 3 m and 6 m from the left end. Draw SFD and BMD for the beam. (10M)

3 A cantilever of length 3 m carries a uniformly distributed load of 1.5 kN/m run over a length of 2 m from the free end. Draw SFD and BMD. (10M)

4 a) Define beam. Sketch three different types of beams indicating name of beam. (3M)

b) Draw the shearing force and bending moment diagrams for the beam shown (7M)



in figure.

5 Simply supported beam of length 6 m carries a uniformly increasing load of 600 N/m at one end to 1500 N/m run at the other end. Draw SFD and BMD (10M) 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 whole length and also derive equation for it. (10M)

7 a) Define the 'Beam' and the type of action and deformation it undergoes. (4M)

b) Draw the S.F and B.M diagram for a S.S.B of span loaded with UDL of W KN/m. (6M)

8 Draw the shear force and bending moment diagram for a simply supported beam AB of span 9 meters carrying a uniformly distributed load of 18 KN per meter for a distance of 4 meters from the left support A. (10M)

9 Draw the shear force and bending moment diagram for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 KN/m for a distance of 6 m from the left end. (10M)

10 Draw the shear force and bending moment for a simply supported beam carrying uniformly varying load from zero at each end to w per unit length at center. (10M)

UNIT-III

1. Derive the bending equation M/I = f/y = E/R Writing all the assumptions made (10M)

2. A cast Iron beam is of T- section has the following dimensions Flange: 100 mm x 20 mm Web: 80 mm x 20 mm. The beam is simply supported on a span of 8 meters and carries a uniformly distributed load of 1.5 KN/m length of entire span. Determine the maximum tensile and compressive stresses. (10M)

3. A timber beam of rectangular section is to support a load of 30 k N 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/mm2, find the dimensions of the cross section. (10M)

4. A rolled steel joint of I- section has the dimensions as following Top flange : 200 x 20 mm Web : 10 x 360 mm and Bottom flange : 200 x 20 mm. The beam carries a udl of 40 KN/m over a span of 10 m. Calculate the maximum stress due to bending. (10M)

5. A beam is simply supported and carries a uniformly distributed load of 40KN/m run 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/mm^2 and moment of inertia of the section is 7×10^{8} mm^4, find the span of the beam. (10M)

6. An I-section has the following dimensions
Flanges: 150 mm x 20 mm Web: 310 mm x 10 mm. If the shear force acting on the section is 40 KN. Calculate the maximum shear stress developed in I-section and stress distribution diagram. (10M)

7. A simply supported beam carries a uniformly distributed load of intensity 30 N/mm 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. (10M)

8. A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 KN. Determine i) Average shear stress ii) **(10M)**

Maximum shear stress iii) Shear stress at a distance of 25 mm above neutral axis.

9. A simply supported wooden beam of span 1.3 m having a cross section 150 mm wide and 250 mm deep carries a point load W at the center. The permissible shear stress is 7 N/mm^2 in bending and 1 N/mm^2 in shearing. Calculate the safe load W. **(10M)**

10. An I-section has 100 mm wide and 12 mm thickness, a web of 120 mm height and 10 mm thickness. The section is subjected to bending moment of 15 KN-m and Shear force of 10 KN. Find the maximum bending stress and maximum shear stress and draw shear stress distribution diagram. **(10M)**

UNIT-IV

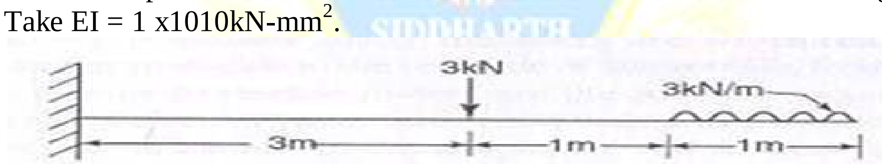
1. Derive the relation between slope, deflection and radius of curvature. (10M)

2. 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 x 1055 N/mm2 and I = 1 x 108 mm^4. (10M)

3. 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 x 105 N/mm2 and I = 85 x 106 mm4. Use Macaulay's method. (10M)

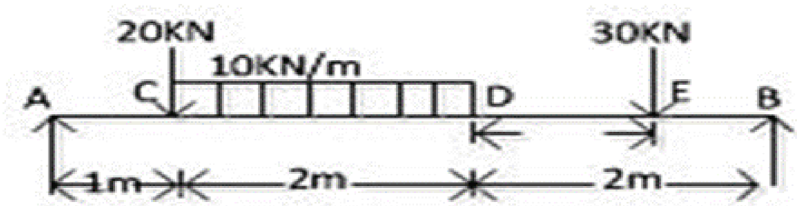
4. A cantilever of length 4 m carries a uniformly distributed load 3 kN/m over a length of 1.5 m from the free end and a point load of 2 KN at the free end. Find the slope and deflection at the free end if E = 2.1 x 105 N/mm2 and I = 6.667 x 107 mm4. (10M)

5. Find the slope and deflection at the free end of the cantilever shown in figure. Take EI = 1 x1010kN-mm^2. (10M)



Fig

6. Determine the deflections at points C, D and E in the beam shown in the figure.
Take E=200KN/mm2 and I=60 x106mm^4. (10M)



7. A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. (rotations per minute) Determine the maximum internal diameter if the maximum stress in the shaft is not exceeded to 60 N/mm^2. (10M)

8. Derive an expression for Torque transmitted by a hollow circular shaft (10M)

9. 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 x10^4 N/mm^2 and C for brass 4.2 x10^4 N/$mm^{2.}$ Find also the maximum shear stress in each material and common angle of twist in a length of 4 m. (10M)

10. A hollow shaft is 1 m long and has external diameter 50 mm. It has 20 mm internal diameter for a part of length and 30 mm for the rest of the length. If the maximum shear stress in it is not exceed 80 N/mm^2 , determine the maximum power transmitted by it at a speed of 300 r.p.m. If the twists produced in the two portions of the shafts are equal ,Find the lengths of the two portions. (10M)

UNIT-V

1. A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If 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= 2x 10^5 N/mm^2poisson's ratio 0.25 (10M)

2. A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made of 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 2x 10^5 N/mm^2 and poisson's ratio 0.3 (10M)

3. Calculate i) change in diameter ii) change in length iii) change in volume of a thin cylindrical shell 100 cm diameter , 1 cm thick and 5 m long when subjected to internal pressure of 3 N/mm^2.Take E = 2x 10^5 N/mm^2poisson's ratio 0.25 (10M)

4. A cast iron pipe 200 mm internal diameter and 12 mm thick is wound closely with a 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 x 10^5 N/mm^2 for cast iron and for steel E = 2 x 10^5 N/mm^2.poisson's ratio is given as 0.3. (10M)

5. A spherical shell of internal diameter 0.9 m and of thickness 10 mm is subjected to an internal pressure of 1.4 N/mm^2. Determine the increase in diameter and increase in volume. 2x 10^5 N/mm^2poisson's ratio = 1/3 (10M)

6. Determine the maximum and minimum hoop stress across the section of a pipe of 400 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. (10M)

7. A compound tube is composed of a tube 250 mm internal diameter and 25 mm thick 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. (10M)

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

9. Define the following terms (10M)
   a) Thin cylinder
   b) Thick cylinder
   c) Circumferential stress
   d) Longitudinal stress
   e) Wire wounding of thin cylinder

10. A steel tube of 200 mm external diameter is to be shrunk on to another steel tube of 60 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= 2x 10^5 N/mm^2 (10M)