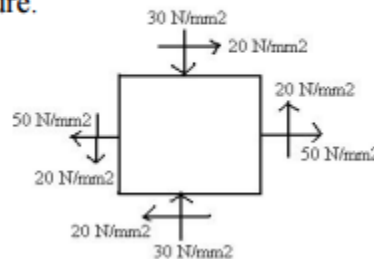


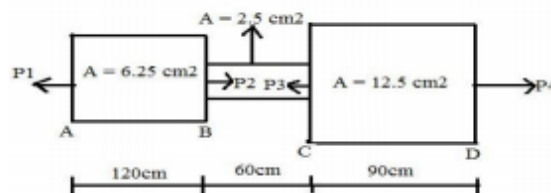
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Anna University Exams Nov / Dec 2016 – Regulation 2013
Rejinpaul.com Unique Important Questions – 3rd Semester BE/BTECH
CE6302 MECHANICS OF SOLIDS
Unit I

1. Estimate the values of change in length, breadth and thickness of a steel bar 4.2m long, 35mm wide and 25mm thick. When subjected to an axial pull of 130kN in the direction of its length. Take $E=200\text{Gpa}$ and poisson's ratio = 0.3.
2. A tension bar is made of 2 parts. The length of 1st part is 300 cm and area is 20cm^2 while the second part is of length 210 cm and 30cm^2 . An axial load of 90kN is gradually applied. Find the total strain energy produced in the bar and compare its value with that obtained in a uniform bar of same length and having same volume under same load. Take $E = 2.1 \times 10^5 \text{ N/mm}^2$.
3. A cast iron pipe of 220 mm internal diameter and 12mm thick is wound closely with a single layer of circular steel wire of 5mm diameter, under a tension of 60N/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 3.5N/mm^2 is admitted into the pipe. Take $E = 2 \times 10^5 \text{ N/mm}^2$ for steel and $E = 2 \times 10^5 \text{ N/mm}^2$ for cast iron and poisson's ratio as 0.3.
4. Determine the direction of principal plane, normal stresses and tangential stress of the strained material as shown in figure.



5. An element in a stressed material has tensile stress of 500 N/mm^2 and compressive stress of 350 N/mm^2 acting on two mutually perpendicular planes and equal shear stresses of 100 N/mm^2 on these planes. Find the principal stresses and its planes. Find the plane of maximum shear stress and its plane.
6. A member ABCD is subjected to point loads P_1 , P_2 , P_3 and P_4 as shown in fig. Calculate the force P_2 necessary for equilibrium if $P_1=4500\text{kg}$, $P_3=45,000\text{kg}$ and $P_4=13,000\text{kg}$. Determine the total elongation of the member, assuming E to be $2.10 \times 10^6 \text{ kg/cm}^2$.

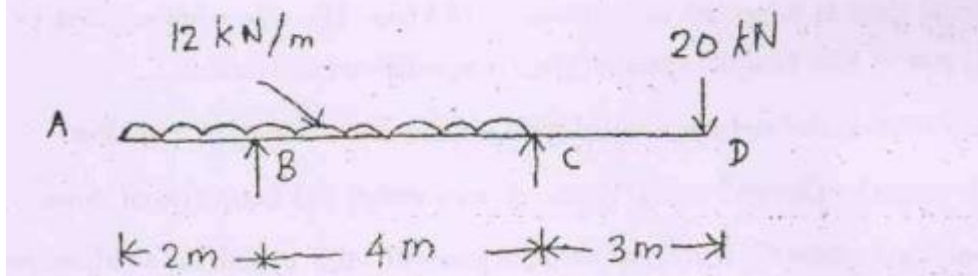


- 7(a) Obtain a relation for change in length of a bar hanging freely under its own weight (b) Derive the relationship between modulus of elasticity and modulus of rigidity

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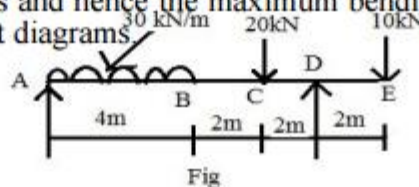
Unit II

1. Draw shear force and bending moment diagram for the beam given in Fig.

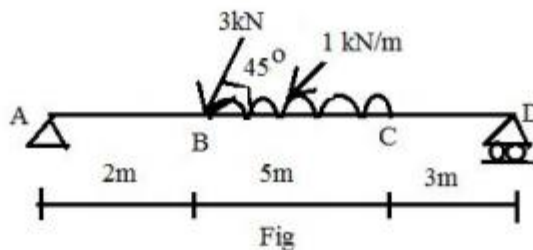


2. The cross section of T beam is as follows: Flange thickness = 10 mm ; width of the flange = 100 mm ; thickness of the web = 10 mm ; depth of the web = 120 mm ; If a shear force of 2 kN is acting at a particular section of the beam design and draw the shear stress distribution across the section

3. For the loaded beam shown in Fig determine (i) The reaction at each support (ii) The bending moment under the loads and hence the maximum bending moment. Also draw the shear force and bending moment diagrams



4. Draw the shear force and bending moment diagram for the beam shown in Fig. Indicate maximum positive bending moment and its location.

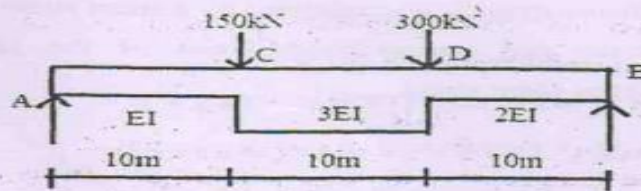


Unit III

- A cantilever of length ' $2a$ ' is carrying a load of W at the free end, and another load of W at its centre. Estimate the slope and deflection of the cantilever at the free end, using conjugate beam method.
- Derive an expression for deflection of a simply supported beam carrying a) an eccentric point load b) UDL throughout its span.

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3. Using conjugate beam method, obtain the slope and deflections at A, B, C and D of the beam shown in fig. Take $E = 200 \text{ GPa}$ and $I = 2 \times 10^{-2} \text{ m}^4$.



OR

4. A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support.

Find :

- (i) Deflection under each load
- (ii) Maximum deflection
- (iii) The point at which the maximum deflection occurs.

Take $I = 85 \times 10^6 \text{ mm}^4$, $E = 2 \times 10^5 \text{ N/mm}^2$

5. A cantilever of length 2.5m is loaded with a udl of 10 kN/m over a length 1.5m from the fixed end and point load 2 kN at 2m from free end. Use Moment area method. a) Design the beam for slope (8 marks) b) Design the beam for deflection at the free end. (8 marks)

Unit IV

1. A shaft has to transmit 110 kW at 160 rpm . If the shear stress is not to exceed 65 N/mm^2 and the twist in a length of 3.5 m must not exceed 1° , find a suitable diameter. Take $C = 8 \times 10^4 \text{ N/mm}^2$.

2. A helical spring in which mean diameter of the coil is 8 times the wire diameter is to be designed to observe 0.2 kN of energy with an extension of 100 mm . the maximum shear stress is not to exceed 125 N/mm^2 . determine the mean diameter of wire and diameter of springs and number of turns also find the load with an extension of 40 mm could be produced in the spring assume $G = 84 \text{ kN/mm}^2$.

3. (i) Derive an expression for strain energy stored in a body due to torsion (8 marks)

4. Two close coiled helical springs wound from the same wire, but with different core radii having equal no. of coils are compressed between rigid plates at their ends. Calculate the maximum shear stress induced in each spring, if the wire diameter is 10 mm and the load applied between the rigid plates is 500 N . the core radii of the spring 100 mm and 75 mm respectively.

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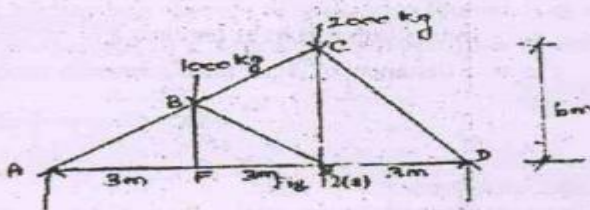
5. A close coiled helical spring has a stiffness of 5N/mm. its length when fully compressed with adjacent coils touching each other is 40 cm. the modulus of rigidity of the material of the spring is $0.8 \times 10^4 \text{ N/mm}^2$. Determine the wire diameter and mean coil diameter if their ratio is 1/10. What is the corresponding maximum shear stress in the spring?
6. A circular shaft of 1000mm diameter and 2m length is subjected to a twisting moment which creates a shear stress of 20 N/mm^2 at 30mm from the axis of the shaft. Calculate the angle of twist and the strain energy stored in the shaft. Take $G = 8 \times 10^4 \text{ N/mm}^2$.

Unit V

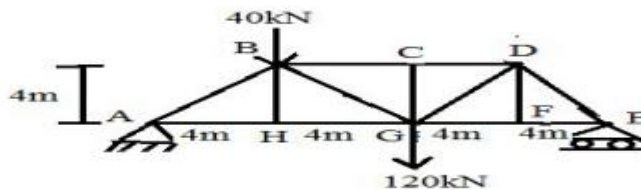
1. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angle to the former. Each of the above stress is accompanied by a shear stress of 63 N/mm^2 . Find (i) The direction and magnitude of each of the principal stress (ii) Magnitude of greatest shear stress.

OR

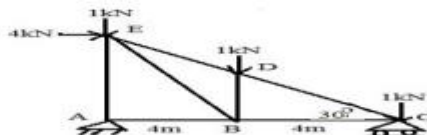
2. Find the magnitude and nature of the forces in the given truss carrying loads as shown in Fig.



3. Determine the forces in all members of a truss as shown in fig.



4. For the truss shown in fig find the forces in members CD, CB, BD and AE by method of joints.



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