

FACULTY OF ENGINEERING

B.E. 2/4 (EE/Inst.) II-Semester (Main) Examination, April / May 2013

Subject : **Solid Mechanics**

Time : 3 Hours

Max. Marks: 75

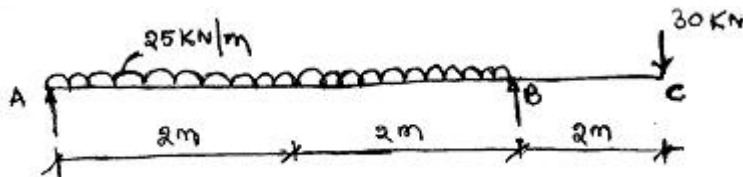
Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Define a term factor of safety and its importance. (2)
2. Draw the stress strain curve for ductile material and brittle material. (3)
3. Differentiate statically determinate and statically indeterminate beams. (2)
4. Distinguish between roller and hinged supports. (3)
5. Write the equation of simple bending and what does each term represent? (2)
- 6.(a) The nature of shear stress distribution in a rectangular beam is _____ (3)
- (b) In a beam of I-section, the maximum shear stress is carried by the
(i) Web (ii) Upper flange (iii) lower flange
7. List out the various methods for finding slope and deflection of a beam. (2)
8. A 1.0 m long bar of rectangular cross section 60mmx 90mm is subjected to axial load of 2KN. Determine the strain energy developed in the bar if the load is suddenly applied. $E = 2 \times 10^5 \text{ N/mm}^2$. (3)
9. Define Torsional stiffness. (2)
10. What is a spring? What is its use? (3)

PART – B (50 Marks)

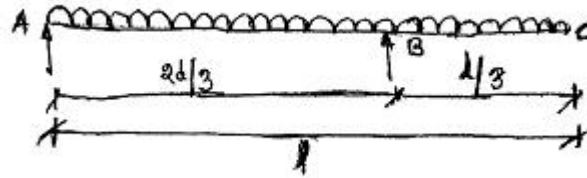
- 11.(a) Deduce an expression among three elastic constants of a materials. (5)
- (b) A steel bar of 10mm diameter is subjected to an axial load of 15 KN. If the change in diameter is found to be 0.0022 mm. Determine the Poisson's ratio, modulus of elasticity and the bulk modulus. Take $G=78 \text{ GPa}$. (5)
- 12.(a) What is point of contraflexure? (3)
- (b) Plot of BM and SF diagram for the beam shown below. (7)



13. A wooden beam is 150 mm deep and 75 mm wide. The beam is simply supported on a span of 3.5 m and is acted upon by a point load of 20 KN at a distance of 1.5 m from one end and a u.d.l. of 25 KN/m over the whole span? Determine the maximum stresses developed in the section. (10)
14. A 100mm x 40 mm I beam is subjected to a shear force of 15 KN. Find the transverse shear stress at the neutral axis and at the top of the web. What is the percentage of shear force carried by the web? Moment of inertia of the section is $1.1 \times 10^6 \text{ mm}^4$ web thickness is 3mm and flange thickness is 4mm. Also draw the shear stress distribution across the section? (10)

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15. A beam of length 'l' is loaded with a u.d.l. 'w' per unit length as shown in the figure. Determine the maximum deflection and also the deflection at point C? (10)



16. A solid shaft transmits 300 kw of power at 100 rpm. Determine the diameter of the shaft if the shear stress is not to exceed 75 MPa. If this shaft is replaced by a hollow shaft whose internal diameter is 0.6 of the external diameter while the length, material and the maximum shear stress are the same, find the percentage saving in weight. (10)
- 17.(a) A steel bar 150 mm^2 of cross section elongates 0.05 mm over a 50 mm gauge length under an axial load of 30 KN. Determine its strain energy. If the load at elastic limit is 50 KN. Find the proof resilience and the elongation. (5)
- (b) The coil diameter of a close coiled helical spring having 10 coils is eight times the wire diameter. The spring absorbs 60 N-M of energy when compressed by 10 mm. Find the coil and the wire diameters and the maximum shear stress. $G=85 \text{ GPa}$. (5)
