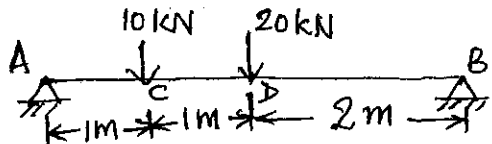
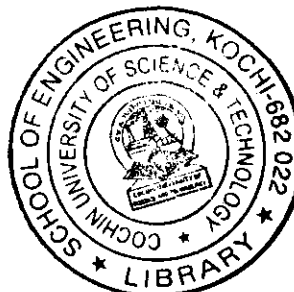


**B. Tech Degree III Semester Examination, November 2009****CE/SE 303 STRENGTH OF MATERIALS***(Common for 1999 & 2002 Schemes)*

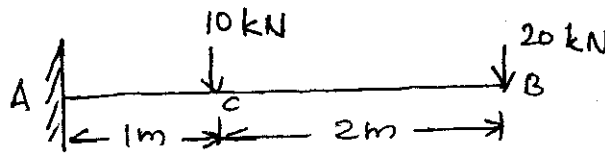
Time : 3 Hours

Maximum Marks : 100

- I. (a) Establish a relation between Young's modulus and Bulk modulus. (8)  
 (b) A steel rod of length 4m and diameter 20 mm is being stayed between two plates at a temperature of  $60^{\circ}\text{C}$ . Find out the force exerted by the rod after it has been cooled to  $20^{\circ}\text{C}$ .  
 (i) if the plates do not yield  
 (ii) if the total yield at the two ends 1mm  
 Take  $E_s = 2 \times 10^5 \text{ N/mm}^2$ ,  $\alpha_s = 12 \times 10^{-6} / ^{\circ}\text{C}$ . (12)
- OR**
- II. (a) Define the following :  
 (i) Resilience (ii) Proof resilience  
 (iii) Modulus of resilience (iv) Strain energy (8)  
 (b) A rectangular element in a strained material is subjected to tensile stresses of  $120 \text{ N/mm}^2$  and  $60 \text{ N/mm}^2$  on mutually perpendicular planes together with a shear stress of  $70 \text{ N/mm}^2$ . Find the principal stresses, principal planes and maximum shear stress in the block. (12)
- III. (a) Derive the relationship between intensity of loading, shear force and bending moment. (8)  
 (b) A simply supported beam AB, 8m long carrying a point load 3kN at 2m from A and a point load 2kN at 5 m from A and a uniform distributed load of 2 kN/m between the point loads. Draw shear force and bending moment diagrams. (12)
- OR**
- IV. (a) A circular pipe of external and internal diameter 100mm and 80 mm respectively is used as a simply supported beam. The span of the beam is 4m. Find the safe concentrated load that the beam can carry at the mid – span if permissible stress in the beam is  $120 \text{ N/mm}^2$ . (10)  
 (b) Compare the moment of resistance of the following sections of same material and of same section area  
 (i) Square section  
 (ii) Circular section. (10)
- V. (a) Find out the equations for slope and deflection of a simply supported beam of length 'L' and uniform EI with a central point load W. Hence evaluate its maximum slope and deflection. (10)  
 (b) A simply supported beam of length 4m and cross section 200 mm x 400 mm is loaded as shown in the figure. Find the slope at the ends A and B and deflection under the point loads. (10)

**OR***(Turn Over)*

- VI. (a) Find the maximum slope and deflection of the cantilever loaded as shown below. Take  $E = 2 \times 10^4 \text{ N/mm}^2$  and  $I = 3.375 \times 10^8 \text{ mm}^4$ . (10)



- (b) Find the maximum slope and deflection of a cantilever beam of length ' $L$ ' carrying a uniformly distributed load of ' $w$ ' per unit length. (10)
- VII. (a) A rolled steel joist ISMB 300 is to be used as a column of 3 meters length with both ends fixed. Find the safe axial load on the column. Take factor of safety as 3,  $f_c = 320 \text{ N/mm}^2$  and  $\alpha = \frac{1}{7500}$ . Properties of the column section.  
 $\text{Area} = 5626 \text{ mm}^2$ ,  $I_{xx} = 8.603 \times 10^7 \text{ mm}^4$   
 $I_{yy} = 4.539 \times 10^7 \text{ mm}^4$  (10)

- (b) Calculate the Euler's critical load for a strut made of circular bar 3m long with both ends fixed. The same bar is found to deflect 10 mm when a load of 15 kN is placed at the centre with bar simply supported at the ends. (10)

OR

- VIII. (a) Derive the torsion equation for circular shafts. (8)  
 (b) Find the maximum torque that can be safely applied to a shaft of 100mm diameter. The permissible shear stress and the allowable twist are respectively  $200 \text{ N/mm}^2$  and  $3^\circ$  per 10 diameter length of the shaft. Take  $C = 1 \times 10^5 \text{ N/mm}^2$ . (12)

- IX. (a) A thick steel cylinder having an internal diameter of 100 mm and an external diameter of 200 mm is subjected to an internal pressure of 55MPa and an external pressure of 7MPa. Find the maximum hoop stress. (10)  
 (b) Show that in case of a thin cylindrical shell subjected to an internal fluid pressure, the circumferential stress is twice the longitudinal stress. (10)

OR

- X. (a) State any two theories of failure. (8)  
 (b) A bolt is subjected to an axial pull of 12kN together with a transverse shear force of 6kN. Determine the diameter of the bolt by using.  
 (i) Maximum Principal Stress Theory  
 (ii) Maximum Strain Theory  
 (iii) Maximum Shear Stress Theory

Take the following data :-

Elastic limit in tension	=	300 N/mm <sup>2</sup>	
Factor of safety	=	3	
Poisson's ratio	=	0.3.	(12)

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