

Roll No																			
---------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023**

Semester : Semester III - 2021

Course Code : CIV2007

Course Name : Sem III - CIV2007 - Strength of Materials

Program : B.Tech. Civil Engineering

Date : 11-JAN-2023

Time : 1.00PM - 4.00PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
 - (ii) Question paper consists of 3 parts.
 - (iii) Scientific and non-programmable calculator are permitted.
-

PART A

ANSWER ALL THE SIX QUESTIONS

6 X 5 = 30M

1. Determine the polar moment of Inertia (J) for a solid circular shaft of 200mm diameter. Also, determine the torsional moment or Torque that the shaft is subjected to if it is transmitting a power of 50kW rotating at a speed of 150rpm
(CO4) [Knowledge]
2. Draw the SFD and BMD for a simply supported beam subjected to a concentrated Load W kN at the center of the span.
(CO2) [Knowledge]
3. A rectangular member of c/s 230mm x 450mm is 2m long and is subjected to a compressive load of 250kN. What will be the deformation developed if Young's Modulus for the material is 2.1×10^5 N/mm². Also, Calculate the intensity of stress and strain developed.
(CO1) [Knowledge]
4. List out the assumptions made in Euler's theory
(CO5) [Knowledge]
5. Define and write the expression for: a) Stress b) Strain c) Modulus of Elasticity
(CO1) [Knowledge]
6. Define Torsional Rigidity and Torsional Strength. Also, write the complete Torsion equation.
(CO4) [Knowledge]

PART B

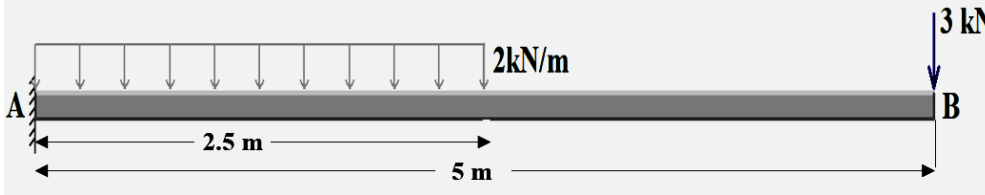
ANSWER ALL THE FOUR QUESTIONS

4 X 10 = 40M

7. A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another. Shafts have many uses in transportation, aerospace, automotive and industrial manufacturing industries. The torsional moment or torque applied to the shaft as a result of its rotation induces shear stress in the shaft. For good design of a shaft, the shear stresses induced are kept within the elastic limit. If you are asked to design a solid circular shaft made up of mild steel to transmit a power of 80kW at 120 rpm, what will be the diameter you would propose for the shaft if the shear stress for steel is not to exceed 75MPa and the torque transmitted by each revolution is expected to exceed the mean by 30%. Take $C = 0.8 \times 10^5 \text{ N/mm}^2$

(CO4) [Comprehension]

8. Sketch the Shear force and Bending moment Diagram for the cantilever beam shown in Figure



(CO2) [Comprehension]

9. TMT steel bar to be used for the construction of a residential apartment complex. A sample of this TMT steel bar is sent to our Basic Material Testing lab for testing. The steel sample of diameter 25mm and gauge length 450mm is tested in the Universal Testing Machine under uniaxial tension test. The results of the test are follows: a. Load at Elastic Limit – 120 kN b. Deformation at 75 kN load – 0.5mm c. Change in diameter at 75kN load – 0.01mm. Based on the test conducted and the results listed above, list out the elastic constants of the material that can be determined. Also, estimate the values of these elastic constants for the given steel material.

(CO1) [Comprehension]

10. The load carrying capacity of columns is dependent on the effective length of columns which is turn influenced by the support conditions of the column at its ends. For a residential project based on architectural constraints, a long rectangular column of 3m length and 230x450mm c/s is adopted. What is the value of moment of inertia for the column to be adopted while determining the Euler's crippling load? Determine the load that the column can carry if both of its ends are fixed adopting Euler's Buckling theory. Compare and comment on the change in load carrying capacity if the ends of the column are hinged. Take $E = 2 \times 10^5 \text{ N/mm}^2$

(CO5) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

2 X 15 = 30M

11. A solid circular shaft is to be designed to transmit 250 kW power at 200 rpm. The allowable shear stress is not to exceed 75MPa. If the solid shaft is to be replaced by a hollow one made up of the same material, what will be the external and internal diameters of the hollow shaft that is required to be provided. The ratio of internal to external diameter may be adopted as 0.6. Compare and comment on the area of solid and hollow shaft obtained. Take $G = 0.8 \times 10^5 \text{ N/mm}^2$

(CO4) [Application]

12. Determine the diameter required to be provided for a solid circular column of 3m length to carry a safe load of 2000kN if the column is fixed at both ends. If the solid column is to be replaced by a hollow column made up of same material, what will be the external and internal diameters of the hollow column that is required to be provided. Compare the area of solid and hollow column obtained and comment. Take internal to external diameter ratio as 0.7, $E = 2 \times 10^5 \text{ N/mm}^2$ and FoS = 1.5.

(CO5) [Application]