Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023

Semester : Semester III - 2021
Course Code : MEC2011
Course Name : Sem III - MEC2011 - Mechanics of Solids
Program : B.Tech. Mechanical Engineering

Date : 9-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 TEN QUESTIONS **10 X 3 = 30M**

1. Define the term Mechanics.
(CO1) [Knowledge]

2. Define the term Load.
(CO1) [Knowledge]

3. Write the pure torsion equation and also mention each term used in it.
(CO2) [Knowledge]

4. Define Beams. Mention any two types of beams.
(CO2) [Knowledge]

5. In what condition maximum shear stress planes are also called plane of pure shear.
(CO3) [Knowledge]

6. Define Stress.
(CO3) [Knowledge]

7. What are principal planes?
(CO3) [Knowledge]

8. Mention the three types of normal strains.
(CO4) [Knowledge]

9. Define Shear Strain with a neat diagram.
(CO4) [Knowledge]

10. Define Modulus of rigidity, bulk modulus and poisson's ratio.
(CO4) [Knowledge]

PART B

ANSWER ALL THE TWO QUESTIONS **2 X 10 = 20M**

11. Derive the expression for the kernel of a circular cross-sectional column with the help of a neat diagram

(CO3) [Comprehension]

12. Draw any four types of supports and show the possible reaction that can develop on each with neat diagram.

(CO4) [Comprehension]

PART C

ANSWER ALL THE FIVE QUESTIONS **5 X 10 = 50M**

13. A hollow shaft of 1 m length is designed to transmit a power of 30 kW at 700 rpm. The maximum permissible angle of twist in the shaft is 1°. The inner diameter of the shaft is 0.7 times the outer diameter. The modulus of rigidity is 80 GPa. Determine the outside diameter (in mm) of the shaft .

(CO2) [Application]

14. A rectangular region in a solid is in a state of plane strain. The (x, y) coordinates of the corners of the undeformed rectangle are given by P(0, 0), Q(4, 3), S(0, 3). The rectangle is subjected to uniform strain ϵ_{xx} = 0.001, ϵ_{yy}= 0.002, γ_{xy} = 0.003. Find the deformed length of the elongated xy diagonal, upto three decimal places?

(CO2) [Application]

15. A hollow shaft (d0 = 2 where d0 and di are the outer and inner diameters respectively) needs to transmit 20 kW power at 3000 RPM. If the maximum permissible shear stress is 30 MPa, d0 is?

(CO3) [Application]

16. A solid circular shaft needs to be designed to transmit a torque of 50 N.m. If the allowable shear stress of the material is 140 MPa, assuming a factor of safety of 2, minimum allowable design diameter in mm is ?

(CO3) [Application]

17. A horizontal bar, fixed at one end (x = 0), has a length of 1 m, and cross-sectional area of 100 mm^2. Its elastic modulus varies along its length as given by E(x) = 100e^{-x} GPa, where x is the length coordinate (in m) along the axis of the bar. An axial tensile load of 10 kN is applied at the free end (x= 1). The axial displacement of the free end is _____ mm.

(CO4) [Application]

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