**PVP 19**

Code: 19ME3401

**II B.Tech - II Semester – Regular Examinations – AUGUST 2021**

# STRENGTH OF MATERIALS
## (MECHANICAL ENGINEERING)

**Assume the suitable data if necessary*

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 5 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each question carries 12 marks.
4. All parts of Question paper must be answered in one place

## PART – A

1. a) Define elastic constants such as young's modulus, and poison's ratio.
   b) What are the different types of beams?
   c) Define Torsion in a solid shaft.
   d) Write the Assumptions for the theory of Simple Bending.
   e) Define the terms: i. Long Column ii. Short column

## PART – B

### UNIT – I

2. a) Derive the relation between E, K and G. 6 M
   b) A 400 mm long bar has rectangular cross-section 10 mm × 30 mm. This bar is subjected to 6 M
   i) 15 kN tensile force on 10 mm × 30 mm faces.
   ii) 80 kN compressive force on 10 mm × 400 mm faces.
   iii) 180 kN tensile force on 30 mm × 400 mm faces.
   Find the change in volume if $E = 2 \times 10^5$ N/mm$^2$ and $\mu = 0.3$.

OR

3. a) A material has modulus of rigidity equal to $0.4 \times 10^5$ N/mm$^2$ and bulk modulus equal to $0.8 \times 10^5$ N/mm$^2$. Find its Young's Modulus and Poisson's Ratio. 6 M

b) A circular rod of 20 mm diameter and 300 mm long is subjected to a tensile force of 50kN. Determine modulus of rigidity, bulk modulus and change in volume if Poisson's ratio is 0.5 and Young's modulus $E = 2 \times 10^5$ N/mm$^2$. 6 M

## UNIT – II

4. a) A cantilever beam AB, 1.8 m long carries a point load of 2.5 kN at its free end and a uniformly distributed load of 1 kN/m from A to B. Draw shear force and bending moment diagrams for the beam. 6 M

b) A simply supported beam of 3 m span carries two loads of 5 kN each at 1 m and 2 m from the left hand support. Draw shear force and bending moment diagrams for the beam. 6 M

OR

5. a) A cantilever beam of length 2m carries a point load of 1kN at its free end and another load of 2kN at a distance of 1m from the free end. Draw the SF and BM diagrams for the cantilever. 6 M

b) Determine Shear Force and Bending Moment for a simply supported beam carrying point load at the center. Also, Draw SF and BM diagrams. 6 M

## UNIT-III

6. a) Derive torsion equation for solid steel shaft. 6 M

   b) A solid steel shaft is to transmit a torque of 10 kN-m. If the shearing stress is not to exceed 45 MPa, find the minimum diameter of the shaft. 6 M

OR

7. a) Derive equations for normal stress, shear stress and resultant stress on a plane normal to which is inclined at $30^0$ to the axis of the bar. 6 M

   b) A steam boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, find the circumferential and longitudinal stresses induced in the boiler plates. 6 M

## UNIT – IV

8. a) A 300 mm × 150 mm I –girder has 12 mm thick flanges and 8 mm thick web it is subjected to a shear force of 150kN at a particular section. Find the maximum shear stress in the web and flange. 6 M

   b) Compare the section moduli of two beams of the weight and length and the beam is solid Circular beam of diameter ‘d’ and the second is a circular tube of outer diameter ‘D1’ and inner diameter ‘D2’. 6 M

OR

9. a) A rectangular beam 300mm deep is simply supported over a span of 4m. Determine the uniformly distributed load per meter which the beam may carry, if bending stress should not exceed 120N/mm$^2$.
Take I=8.0x10$^6$mm$^4$ 7 M

b) Derive the Bending moment equation. 5 M

## UNIT – V

10. a) Explain briefly Macaulay's method with a suitable example. 6 M

b) Determine the deflection of cantilever beam with a point load at the free end by double integration method. 6 M

OR

11. a) A solid round bar 3m long and 5cm in diameter is used as column. Determine the crippling load for all the end conditions. Take E=2 X 10$^5$ N/mm$^2$ 6 M

b) Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E = 205 GPa. 6 M