Sr. No 013302

# B.Tech (ME) 3rd Sem., January 2023
## Strength of Materials-I
## (PCC-ME-302-21)

**Time: 3 Hours** **Max. Marks:75**

***Instructions:***

1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume suitable value for any missing data.*

## PART -A

Q1 (a) Define shear force and give its sign conventions. (1.5)

(b) Write two equations used to find the forces in compound bars made of two materials subjected to tension. (1.5)

(c) Write the relation between loading, shear force and bending moment. (1.5)

(d) State and explain Hoop stress. (1.5)

(e) Write down the equation for maximum shear stress of a solid circular section in diameter ' D ' when subjected to torque ' T' ? (1.5)

(f) Write about Mohr's theorems? (1.5)

(g) Name various methods used to find slope and deflection. (1.5)

(h) Differentiate open coiled helical spring from the close coiled helical spring and state the type of shear induced in each spring due to an axial load. (1.5)

(i) Distinguish between slope and deflection of a beam. (1.5)

(j) Define principal plane and principal stresses. (1.5)

## PART -B

Q2 (a) Find the value of P and the change in length of each component and the total change in length of the bar shown in figure 1 below. (9)

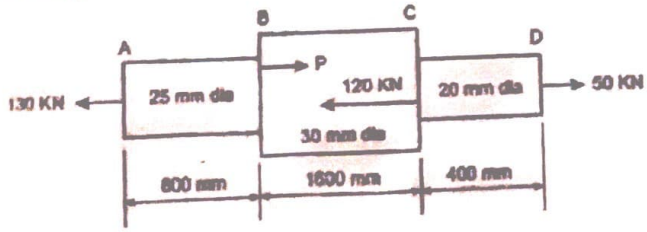


Figure 1

(b) Derive a relation for E, G and m (Poisson ratio) as; E=2G( 1+(1/m)). (6)

Q3 (a) A cantilever of 4m span length carries a load 40 KN at its free end. If the deflection at the free end is not to exceed 8mm, what must be the moment of (7)

inertia of the Cantilever section?

(b) A simply supported 6m rolled steel joist carries a U.D.L of 10 KN//m length. Determine slope and deflection at a distance of 3m from one end of the beam. (8)

Q4 Draw the shear force and bending moment diagrams for a beam shown below figure 2. Clearly mark the position of the maximum bending moment and determine its value. (15)

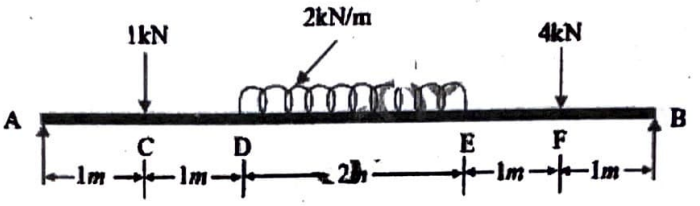


Figure 2

Q5 (a) The diameter ratio of a hollow shaft is 3:5 It is required to transmit 600 kw at 100 rpm. The maximum torque being 12% greater than the mean. If the twist in a length of 3m is not to exceed10 and the shearing stress is limited to 60 $MN/m^2$. Calculate the minimum external diameter of the shaft satisfying these conditions. Take G = 80 $X10^3$ $MN/m^2$. (15)

Q6 (a) Derive an expression for Lame equation for thick cylinder. Discuss the assumption made. (5)

(b) A cylindrical shell 3m long which is closed at the ends, has an internal diameter of 1m and a wall thickness of 20mm. calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of $2.0N/mm^2$. Take $E=2x10^5N/mm^2$ and 1/m=0.3. (10)

Q7 A beam 100 mm wide and 150 mm deep in cross-section is simply supported and carries a uniformly distributed load over its entire span of 2 m. If the allowable stresses for the beam material are 30 MPa in bending and 2 MPa in shear, calculate the maximum load which the beam can carry. (15)

**********