

March 2022

B-Tech (ME) 3rd Sem
Strength of Materials (PCC-ME-203)

Time: 90 Minutes

Max. Marks: 25

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

PART -A

- Q1 (a) Write two equations used to find the forces in compound bars made of two materials subjected to tension. (1)
- (b) What is uniformly distributed loads? (1)
- (c) What are the assumptions made in the theory of bending? (1)
- (d) Write down the equation for maximum shear stress of a solid circular section in diameter 'D' when subjected to torque 'T'? (1)
- (e) 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)
- (f) What is meant by double integration method for deflection in beam? (1)
- (g) What is the Mohr's circle? (1)
- (h) Distinguish between cylindrical shell and spherical shell. (1)
- (i) Define principal plane and principal stresses. (1)
- (j) What is a shear center? (1)

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. (3)

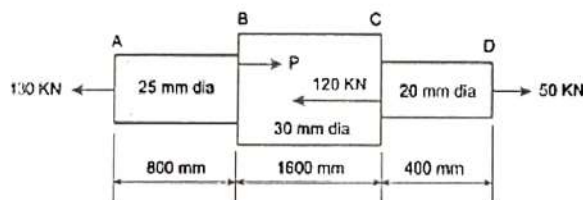


Figure 1

- (b) Derive a relation for E, G and m (Poisson ratio) as; $E = 2G(1 + (1/m))$. (2)
- Q3 (a) For the simply supported beam loaded as shown in figure 2. Draw the shear force diagram and bending moment diagram. Also, obtain the maximum bending moment. (5)

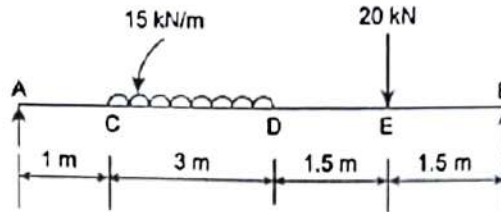


Figure 2

- Q4 A beam is simply supported as its ends over a span of 10m and carries two concentrated loads of 100kN and 60kN at a distance of 2m and 5m respectively from the left support. Calculate (5)
- slope and deflection at the left support;
 - slope and deflection under the 100kN load. Assume $EI=36 \times 10^4 \text{ kN-m}^2$
- Q5 (a) A close coil helical spring of round steel wire 10mm in diameter has a mean radius of 120mm. the spring has 10 complete turns and is subjected to a axial load of 200N. Determine (3)
- Deflection of the spring.
 - Maximum shear stress in the wire and.
 - Stiffness of the spring. $G=80 \text{ kN/mm}^2$.
- (b) A solid circular shaft is subjected to a torque of 150N-m. find the maximum diameter required if the allowable shear stress is 100 N/mm^2 and allowable twist is 1° per 3m length of shaft. $C=100 \text{ kN/mm}^2$. (2)
- Q6 (a) Derive an expression for Lamé equation for thick cylinder. Discuss the assumption made. (2)
- (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 2.0 N/mm^2 . Take $E=2 \times 10^5 \text{ N/mm}^2$ and $\nu=0.3$. (3)
