ME 212 (R-22)

Total No. of Questions : 10] [Total No.of Pages : 03

II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

First Semester

MECHANICAL ENGINEERING

STRENGTH OF MATERIALS - I

Time : **Three Hours** Maximum : **70** Marks

Answer ONE Question from each Unit. 5x14=70 M

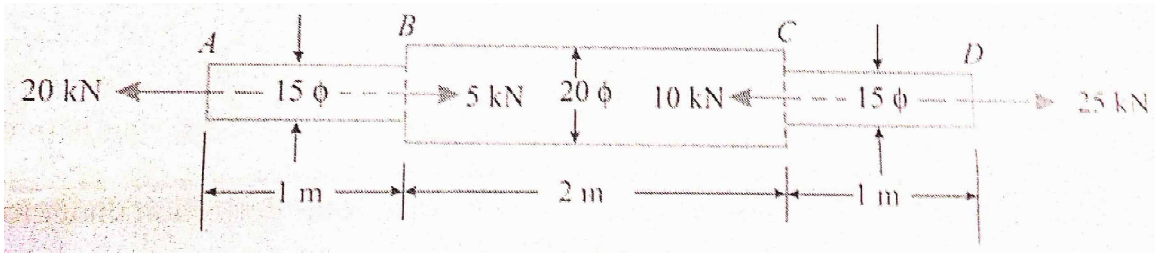
All Questions carry equal marks.

UNIT - I

1. a) Define the following :

   (i) Factor of safety (ii) Poisson's ratio (iii) Hooks law

   b) A steel bar ABCD 4m long is subjected to forces as shown in fig. Find the elongation of the bar. Take E for stell has 200 GPa.



(OR)

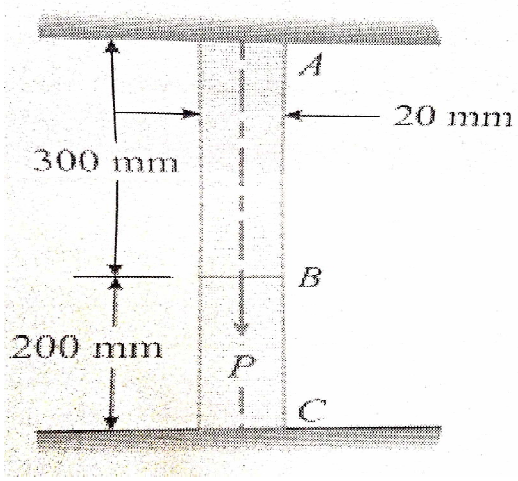
2. a) A steel rod which tapers uniformly from 5cm diameter to 3cm diameter in the length of 50 cm, is subjected to an axial load of 6000N. If E = 2 x 10^5 N/mm^2, find the extension of the rod.

   b) Distinguish between : stress and strain, normal stress and shear stress, working stress and yield stress.

UNIT - II

3. A square bar of 20 mm side is held between two rigid plates and loaded by an axial force P equal to 450 kN as shown in below Fig. Find the reactions at ends A and C and the extension of the portion AB. Take E = 200 GPa.

P.T.O.



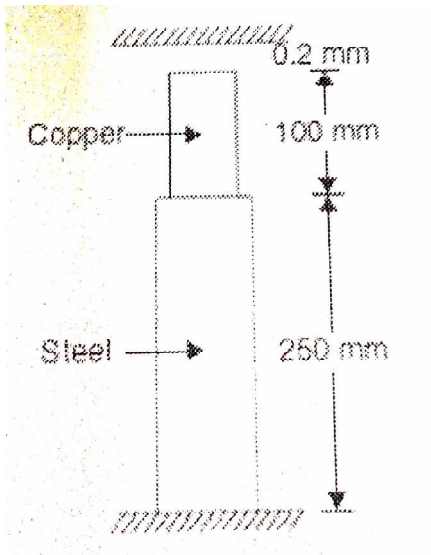
(OR)

4. The composite bar shown in Fig is 0.20 mm short of the distance between the rigid supports at room temperature. What is the maximum temperature rise which will not produce stresses in the bar ? Find the stresses induced in the bar when the temperature rise is 60°. Given :

$\alpha_s = 12 \times 10^{-6}/°C$, $\alpha_c = 17.5 \times 10^{-6}/°C$

$E_s = 2 \times 10^5$ N/mm^2, $E_c = 1.2 \times 10^5$ N/mm^2

$A_s = 400$ mm^2, $A_c = 300$ mm^2



UNIT - III

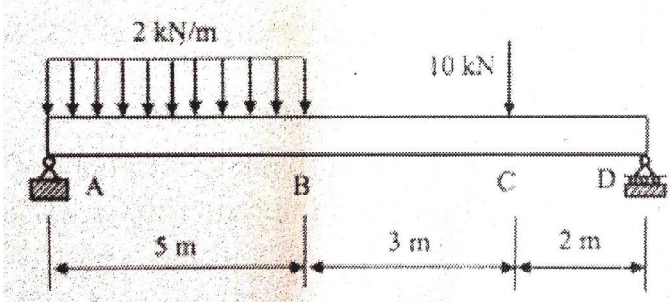
5. A solid shaft is to transmit 300 kW at 100 rpm if the shear stress is not to exceed 80 N/mm^2. Find the diameter of the shaft. If this shaft was to be replaced by a hollow shaft of the same material and length with an internal diameter of 0.6 times the external diameter. What percentage saving in weight is possible ?

(OR)

6. A laminated spring 1 m long is built in 100 mm x 10 mm plates. If the spring is to carry a load of 10 kN at its center, determine the number of plates required for the spring. Take allowable bending stress as 150 MPa. Take E = 210 GPa, what is the deflection under load?

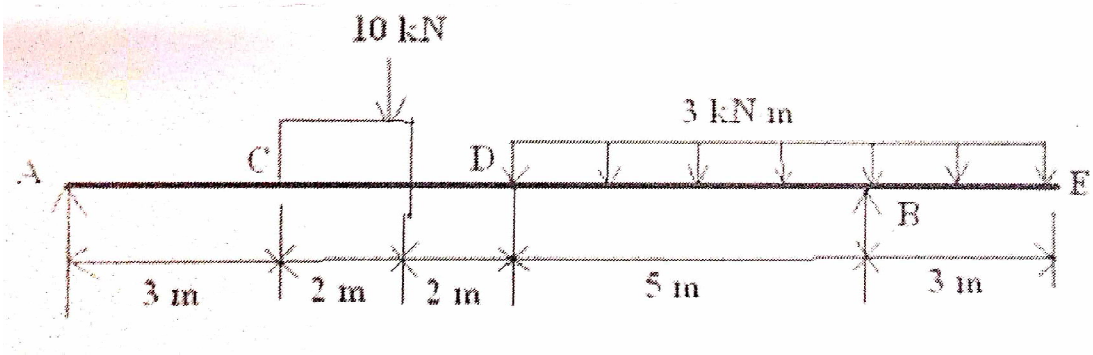
UNIT - IV

7. Draw the Shear force and bending moment diagram for the loaded beam as shown in Figure.



(OR)

8. A simply supported overhanging beam is load as shown in the Figure. Draw the shear force and bending moment diagrams.



UNIT - V

9. The shear force acting on the beam at an I-section with unequal flanges is 50kN. The section is shown in figure (i) the moment of inertia of a section about N. A is 2.849 x 10^4. Calculate the shear stress at the N.A. and also draw the shear stress distribution over the depth of the section.

(OR)

10. The stresses on two mutually perpendicular planes through a point in a body are 90 MPa and 60 MPa, both being tensile. Determine the maximum value of shear stress that can be applied so that the maximum value of permissible principal stress is limited to 140 MPa. What will be the direction of the principal stress and the magnitude of the maximum shear stress ?