CBCS SCHEME

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15MN34

# Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
## Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***



### Module-1

1 a. Define the following :
i) Working stress and factor of safety
ii) Hooke's Law
iii) Draw stress – strain relation for cast iron
iv) Draw stress – strain relation for hard and soft rubber. **(08 Marks)**

b. The following data refer to a mild steel specimen tested in a laboratory.
Dia of specimen = 25mm
Extension under a load of 20kN = 0.04mm
Gauge length = 200mm
Load at yield point = 150kN
Maximum load = 225kN
Length of specimen after failure = 275mm
Neck diameter = 18.25mm
Determine :
i) Young's modulus
ii) Ultimate stress
iii) Percentage elongation
iv) Percentage reduction in area. **(08 Marks)**

**OR**

2 a. Derive an expression for stress and total elongation in an uniformly tapering circular bar. **(08 Marks)**

b. A bar of diameter 20mm and length 100mm extends by 0.2mm. If E of the material of the rod is $2 \times 10^5 N/mm^2$, What load and type of load applied to the rod. If an extension of 20% greater is required for the same load applied above, how much the diameter of the bar need to be reduced. **(08 Marks)**

### Module-2

3 a. Define the following :
i) Young's modulus
ii) Shear modulus
iii) Bulk modulus
iv) Poisson's ratio. **(08 Marks)**

b. Determine the changes in length, width and thickness of a steel bar which is 4m long, 30mm wide and 20mm thick and is subjected to an axial pull of 30kN in the direction of length, $E = 2 \times 10^5 N/mm^2$ and Poisson's ratio = 0.3. Also determine the volumetric strain, change in volume and final volume of the given bar. **(08 Marks)**

**OR**

4 a. Define thin and thick cylinder. **(02 Marks)**

b. A steel penstock of 100cm diameter and 10mm thick is subjected to $10^5$mm head of water.

c. Calculate the hoop stress and longitudinal stress at the bottom of the penstock. **(06 Marks)**

A boiler shell is to be made of 20mm thick plates having a limiting tensile stress of 125N/mm$^2$. If the efficiencies of the longitudinal and circumferential joints are 80% and 30% respectively. Determine :

i) Maximum permissible diameter of the shell for an internal pressure of 2.5N/mm$^2$

ii) Permissible intensity of internal pressure when the shell diameter is 1.6m. **(08 Marks)**

## Module-3

5 a. Define shear Force diagram and Bending moment diagram. **(04 Marks)**

b. Draw shear force diagram and bending moment diagram for the beam shown in Fig.Q5(b).

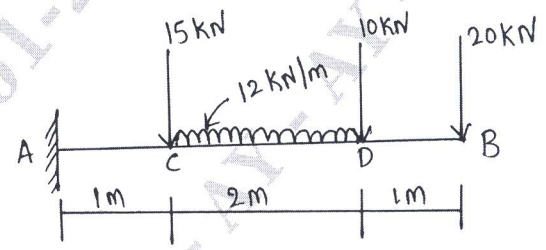


Fig.Q5(b) **(12 Marks)**

**OR**

6 a. List the different types of loads acting on a beam. **(04 Marks)**

b. Draw shear force and bending moment diagram for the beam shown in Fig.Q6(b).

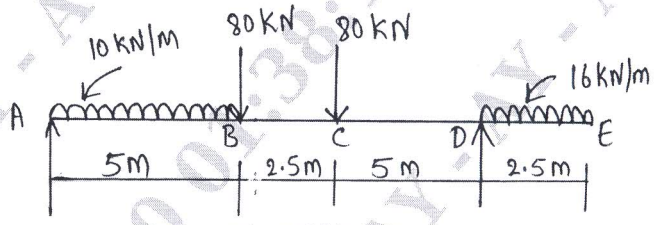


Fig.Q6(b) **(12 Marks)**

## Module-4

7 a. Derive Bernoulli–Euler bending equation. **(08 Marks)**

b. A cast iron bracket of I–section with equal flanges is as shown in Fig.Q7(b). The beam carries an UdL of 10 kN/m on a span of 10m length. Determine the position of neutral axis, MI about the neutral axis and the maximum stress distribution.

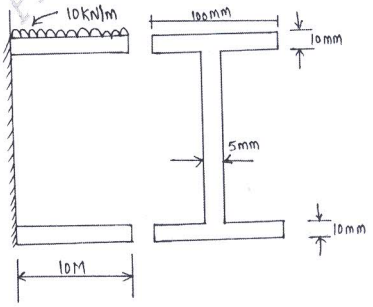


Fig.Q7(b) **(08 Marks)**