CBCS SCHEME

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17MT33

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the stress – strain curve for mild steel. **(04 Marks)**

b. Derive the expression for the change in length of uniformly tapering circular bar. **(08 Marks)**

c. Determine the magnitude of the load 'P' necessary to produce zero net change in the length of the straight bar shown in Fig Q1(c) A = 400mm^2.

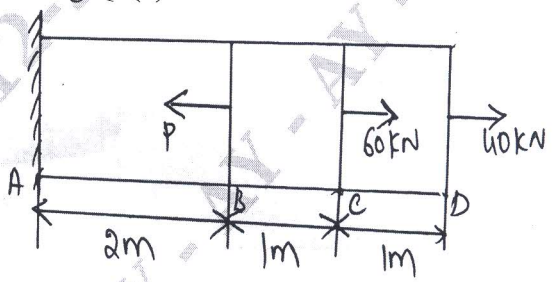

Fig Q1(c) **(08 Marks)**

OR

2 a. Derive Relation between modulus of Elasticity and modulus of Rigidity. **(10 Marks)**

b. Define the following :

i) Factor of safety
ii) Modulus of Rigidity
iii) Poisson's ratio
iv) Bulk modulus
v) Modulus of Elasticity. **(10 Marks)**

Module-2

3 a. Define principal stresses and principal planes. **(04 Marks)**

b. The state of stress in 2 dimensionally stressed body is shown in Fig Q3(b). Determine the principal stresses, principal planes, maximum shear stress and their planes, also draw the Mohr's circle to verify the results obtained analytically.

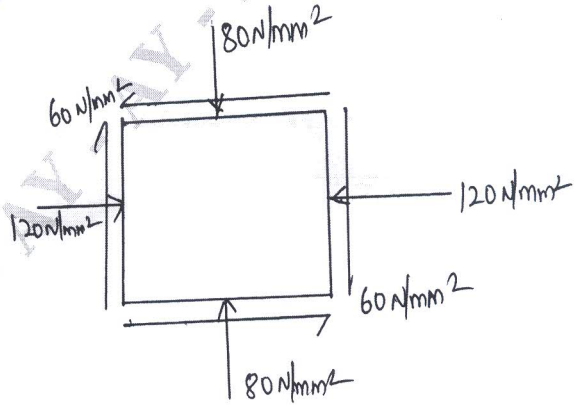

Fig Q3(b) **(16 Marks)**

OR

4 At a point in a strained material, there are 2 mutually perpendicular tensile stresses $400N/mm^2$ and $300N/mm^2$, there is also a shear stress of $200N/mm^2$. Determine by Mohr's circle method, the magnitude and direction of principal stresses and the shear stress. **(20 Marks)**

Module-3

5 a. Define the following :
i) Sagging Bending Moment
ii) Point of Contra-flexure
iii) Hogging Bending Moment **(06 Marks)**

b. A simply supported beam AB of 6m span is loaded as shown in Fig. Q5(b). Draw shear force and bending moment diagram also indicate the point of contra-flexure if any.

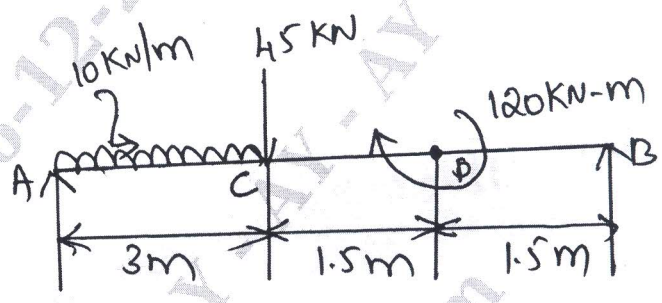

Fig Q5(b) **(14 Marks)**

OR

6 a. Derive the relationship between load, shear force and Bending moment. **(06 Marks)**

b. For the beam shown in Fig Q6(b) draw the SFD and BMD. Locate the point of contra-flexure if any.

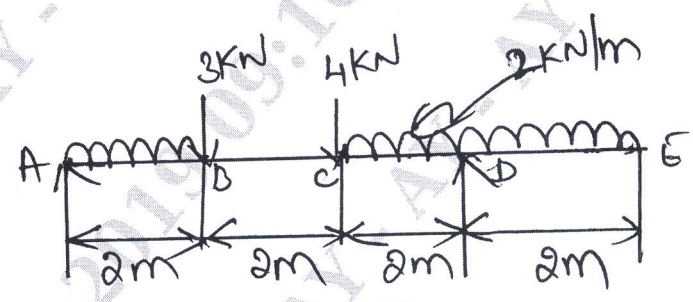

Fig Q6(b) **(14 Marks)**

Module-4

7 a. With assumptions derive $\frac{M}{I}=\frac{\sigma}{y}=\frac{E}{R}$ with usual notations. **(10 Marks)**

b. A cast iron test beam 25mm × 25mm cross section and 1m long, supported at its ends fail when a central load of 800N is applied on it. What UDL will break a cantilever of the same material 50mm wide, 100 mm deep and 2m long? **(10 Marks)**

OR

8 a. Derive Euler Bernoulli equation for deflection. **(10 Marks)**

b. Derive the expression of a cantilever beam with a point load at the Free end. **(10 Marks)**

Module-5

9 a. state the assumptions in the theory of pure torsion and derive the torsion equation $\frac{T}{J} = \frac{Z}{R} = \frac{G\theta}{L}$. **(12 Marks)**

b. Find the maximum torque that can be applied to a shaft of 300mm diameter. The permissible angle of twist is 1.5° in a length of 5m and the shear stress is not exceed $42N/mm^2$. G = 84GPa. **(08 Marks)**

OR

10 a. Explain the assumptions in Euler's column theory. Derive Euler's expression for buckling load for column with both ends are fixed. **(10 Marks)**

b. A 1.5m long column has a circular cross section of 50mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking the factor of safety as 3, calculate the safe load using

i) Rankine's formula taking yield stress $560N/mm^2$ and $\alpha = \frac{1}{1600}$

ii) Euler's formula taking $E = 1.2 \times 10^5 N/mm^2$. **(10 Marks)**

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