CBCS SCHEME

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15MT33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

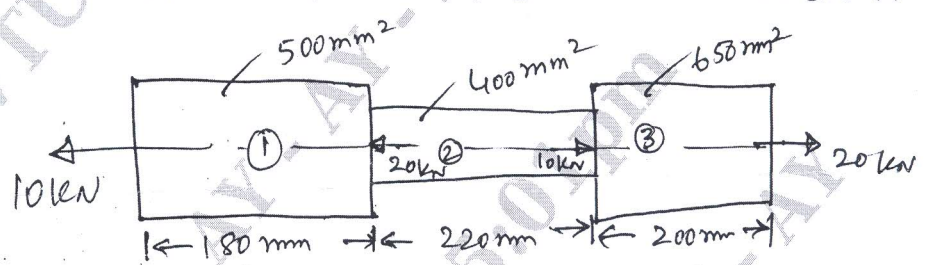
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define the following:
i) Poisson's ratio
ii) Factor of safety
iii) Hooke's law
iv) Young's modulus **(04 Marks)**

b. Mention the assumption made in the theory of simple stress and strain and derive the equation $dL = \left(\frac{PL}{AE}\right)$. **(04 Marks)**

c. Determine (i) Stress induced in each position and (ii) Net deformation in the bar. Take E = 200 GPa for stepped bar subjected to varying loads as shown in Fig,Q1(c).



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

OR

2 a. Derive an expression for the total extension of the tapered circular bar across section of dia 'd_1' and 'd_2', when it is subjected to an axial pull of load 'P'. **(08 Marks)**

b. Derive an expression for relation between E, G and μ as $E = 2G(1 + \mu)$. **(08 Marks)**

Module-2

3 a. Define principal stress and principal plane. **(02 Marks)**

b. The direct stresses acting at a point in a strained material as shown in Fig.Q3(b). Find the normal, tangential and the resultant stresses on a plane 30° to the plane of major principle stress. Find the obliquity of the resultant stress also.

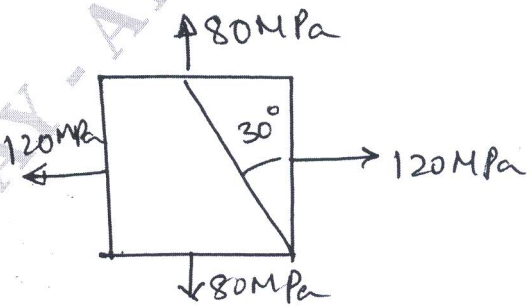


Fig.Q3(b) **(06 Marks)**

c. A plane element is subjected to stresses as shown in Fig.Q3(c). Determine principle stress, maximum shear stress and their planes. Sketch the planes determined.

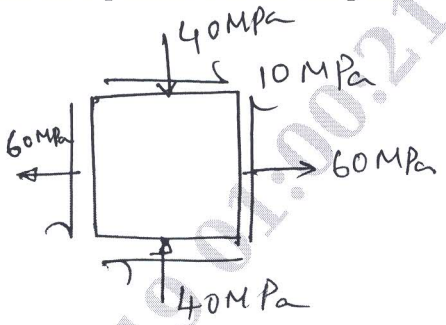


Fig.Q3(c) **(08 Marks)**

OR

4 a. Derive an expression for circumferential and longitudinal stress for thin cylinder subjected internal pressure 'P'. **(08 Marks)**

b. Derive Lames equation for thick cylinder. **(08 Marks)**

Module-3

5 a. Explain shear force, bending moment, hogging moment, sagging moment, point of contraflexure. **(05 Marks)**

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

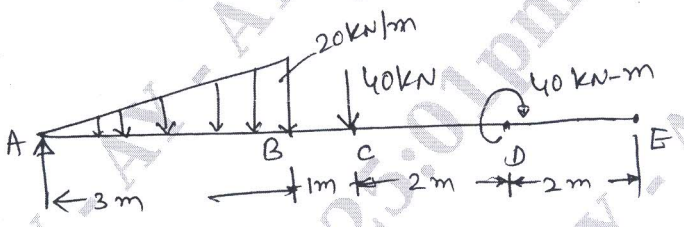


Fig.Q5(b) **(11 Marks)**

OR

6 Draw the SFD and BMD for the beam shown in Fig.Q6. Find the point of contraflexure.

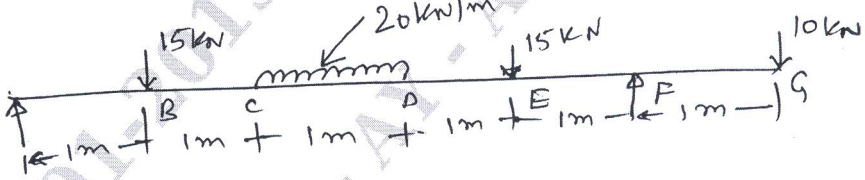


Fig.Q6 **(16 Marks)**

Module-4

7 a. Prove that relation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$. **(10 Marks)**

b. Show that maximum shear stress of rectangular section is 1.5 times the average shear stress. **(06 Marks)**

OR

8 a. Derive an expression $M = EI.\frac{d^2y}{dx^2}$. **(10 Marks)**

b. Derive an expression for maximum deflection in a cantilever beam subjected to a point load at free end. **(06 Marks)**

Module-5

9 a. Derive general equation for torsion $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$. **(10 Marks)**

b. Explain the following:
- i) Torsional strength
- ii) Torsional rigidity
- iii) Torsional flexibility
- iv) Section modulus of solid shaft
- v) Section modulus of hallow shaft
- vi) Rigidity modulus **(06 Marks)**

OR

10 a. Derive Euler's buckling load for column with its both end hinged. **(10 Marks)**

b. A hallow cast iron whose outside dia is 200 mm and thickness 20 mm is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankines formula using a FOS of 2.5. Find the ratio of Euler's to Rankines loads. Take $E = 1 \times 10^5$ MPa, Rankine constant = 1/1600 and $\sigma_y = 550$ MPa. **(06 Marks)**

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