CBCS SCHEME

USN | | | | | | | | | | |

15MR34

Third Semester B.E. Degree Examination, June/July 2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

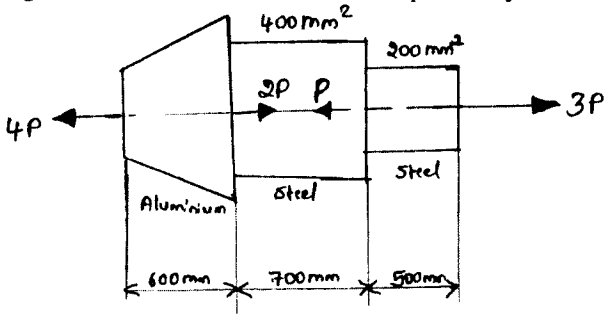
Module-1

1 a. Define: i) Hook's law ii) Poisson's ratio iii) Bulk Modulus. **(03 Marks)**

b. Obtain an expression for extension of a bar with continuously varying circular section. **(05 Marks)**

c. A round bar with stepped portion is subjected to the forces as shown in Fig.Q.1(c). Determine the magnitude of force P, such that net deformation in the bar does not exceed 1mm E for steel is 200GPa and Aluminium is 70GPa. Big end diameter and small end diameter of the tapering bar are 40mm and 12.5mm respectively. **(08 Marks)**

Fig.Q.1(c)



OR

2 a. Obtain relation between modulus of elasticity and modulus of rigidity. **(08 Marks)**

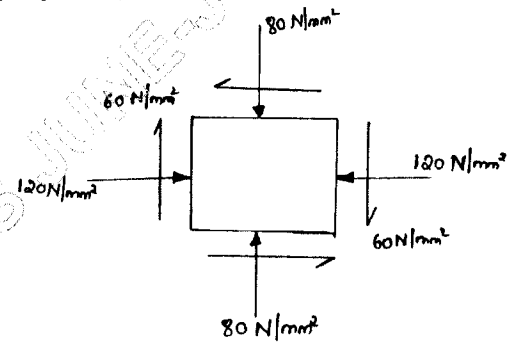
b. A steel bar is placed between two copper bars, each having the same area and of length L as the steel bar at 15°C. At this stage, they are rigidly connected together at both the ends. The length of composite bar is also L. When the temperature is raised to 315°C, the length of the bar increase by 1.5mm. Determine the original length and find the stresses in the bars.
Take : $E_s = 2.1 \times 10^5$ N/mm^2, $E_c = 1 \times 10^5$ N/mm^2
$\alpha_s = 0.000012$ per °C, $\alpha_c = 0.0000175$ per °C. **(08 Marks)**

Module-2

3 a. Explain construction of Mohr's circle for stresses. **(06 Marks)**

b. The state of stress in two dimensionally stressed body is shown in Fig.Q.3(b). Determine the principal stresses, principal planes, maximum shear stress and their planes. **(10 Marks)**

Fig.Q.3(b)



OR

4 a. Derive an expression for circumferential stress and longitudinal strain for thin cylinder. **(06 Marks)**

b. A pipe of 500mm internal diameter and 75mm thick is filled at a pressure of 6 N/mm^2. Find the maximum and minimum hoop stress across the cross section of the cylinder. Also sketch the radial pressure and hoop stress distribution across the section. **(10 Marks)**

Module-3

5 a. Derive an expression to establish a relationship between the intensity of load, shear force and bending moment. **(06 Marks)**

b. A cantilever beam carries udl and point loads shown in Fig.Q.5(b). Find the reactions at the fixed end and draw the SFD and BMD. **(10 Marks)**

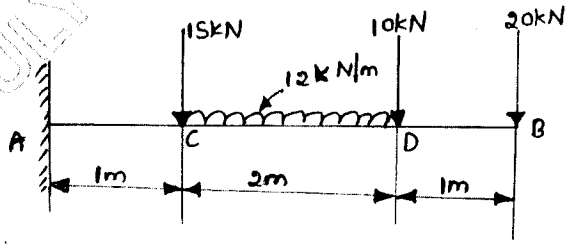


Fig.Q.5(b)

OR

6 a. Explain with simple sketches, different types of beams subjected to different types of loads. **(06 Marks)**

b. A simply supported beam of span 6m is subjected to a concentrated load of 25kN acting at a distance of 2m from the left end. Also subjected to an uniformly distributed load of 10kN/m over entire span as shown in Fig.Q.6(b). Draw the bending moment and shear force diagrams indicating the maximum and minimum values. **(10 Marks)**

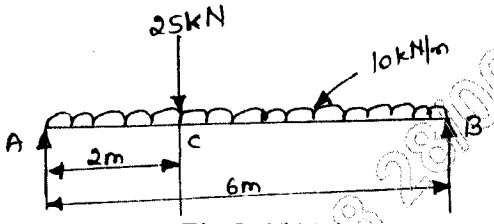


Fig.Q.6(b)

Module-4

7 a. Prove that $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$ with usual notations. **(08 Marks)**

b. A cast iron test beam 25mm × 25mm cross-section and 1m long, supported at its ends fall when a central load of 800N is applied on it. What udl will break a cantilever of same material 50mm wide, 100mm deep and 2m long? **(08 Marks)**

OR

8 a. Define pure bending and write the assumptions made in the bending theory. **(06 Marks)**

b. Using double integration method, determine the slope and deflection for a cantilever beam subjected to udl. **(10 Marks)**

Module-5

9 a. State the assumptions made in pure torsion and derive the relationship between angle of twist and shear stress. **(08 Marks)**

b. A solid circular shaft has to transmit a power of 1000kW at 120rpm. Find the diameter of the shaft, if the shear stress of the material must not exceed 80 N/mm^2. The maximum torque 1.25 times of its mean. What percentage of saving in material would be obtained if the shaft is replaced by a hollow one whose internal diameter is 0.6 times its external diameter, the length, material and maximum shear stress being same? **(08 Marks)**

OR

10 a. State assumptions made in Euler's theory for elastic long columns and derive relation for crippling load for column with one end fixed and other end free. **(08 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 other end is free. Taking the factor of safety as 3, calculate the safe load using

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

ii) Euler's formula, taking E = 1.2×10^5 N/mm^2. **(08 Marks)**

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