Total No. of Questions—8]   [Total No. of Printed Pages—4+1

[5152]-502

S.E. Civil (First Semester) EXAMINATION, 2017
STRENGTH OF MATERIAL
(2015 PATTERN)

Time : Two Hours   **Maximum Marks : 50**

N.B. :— (i) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6**, Q. **7** or Q. **8**

(ii) Neat sketches must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

(v) Use of electronic pocket calculator is allowed.

(vi) Use of cell phone is prohibited in the examination hall.

1. (a) The bar is tested in a Universal Testing Machine. It is observed that at a load of 40 kN the total extension of the bar is 0.285 mm. Determine the Young's modulus of the bar material. [6]
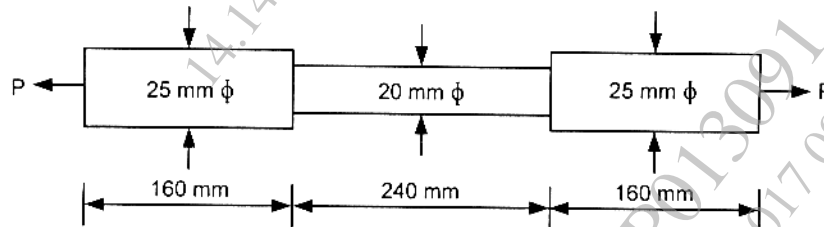
(b) A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2.5 m. Find the maximum concentrated load that can
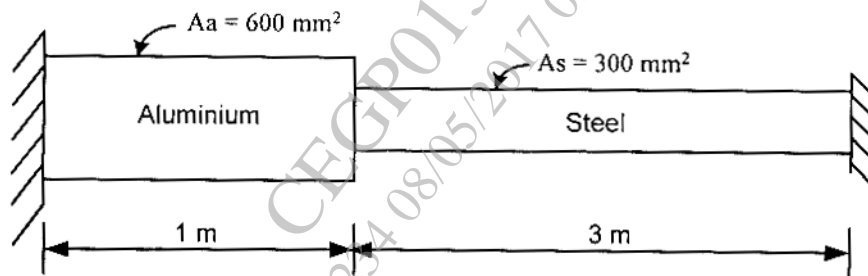
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be applied at the Centre of the span if the permissible stress in the tube is 150 N/mm². [6]
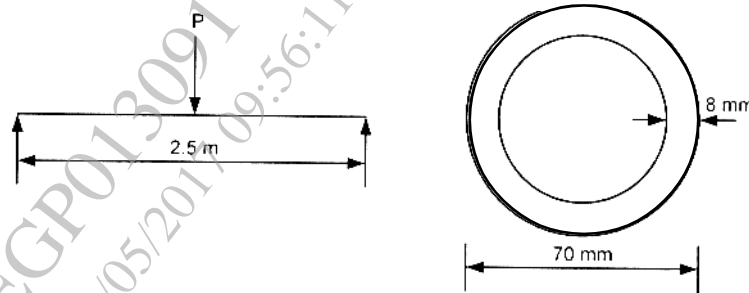
Or

2. (*a*) A composite bar is rigidly fitted at the supports A & B as shown in figure. Determine the reactions at the supports when the temperature rises by 20°C. Take $E_a = 70$ GN/m², $E_s = 200$ GN/m², $\alpha_a = 11 \times 10^{-6}/°C$ and $\alpha_s = 12 \times 10^{-6}/°C$. [6]

(*b*) A T section 100 mm × 130 mm × 20 mm is subjected to a Shear force of 100 kN. Draw the shear stress distribution and find the maximum shear stress. [6]

3. (*a*) A hollow shaft transmits 100 kW at 120 r.p.m. Allowable shear stress in material is 50 N/mm². Shaft shall not twist 2° in 1 m length. Ratio of Internal diameter to external diameter is 0.25. Take G = 80 kN/mm². Maximum torque is 15 % more than Mean torque. Calculate maximum external diameter of a shaft. [6]

(b) At a point in a beam the normal stress along the length is 80 N/mm². The stress at that point is positive magnitude of 35 N/mm². Find the stresses on a plane whose normal is inclined at 30° to the longitudinal axis. Also find the principal stresses and planes on which they act. [6]

Or

4. (a) A load of 500 N falls freely through a height of 150 mm on to a collar attached to the end of a vertical rod of 50 mm diameter and 2 *m* long, the upper end of the rod being fixed to the ceiling. Calculate the maximum instantaneous extension of the bar and also calculate the maximum stress in the bar. Assume E = 200 GPa. [6]

(b) What is meant by torque ? State the assumptions made in the determination of shear stress in circular shafts subjected to torsion. [6]

5. (a) Draw Shear Force Diagram and Bending Moment Diagram of a simply supported beam as shown in figure. [7]
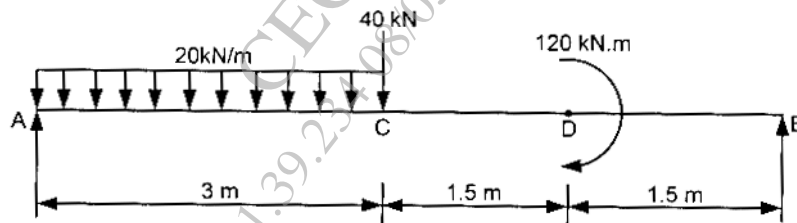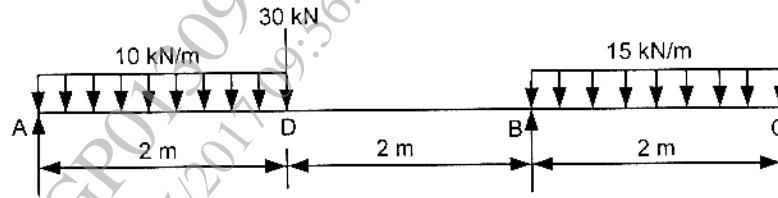

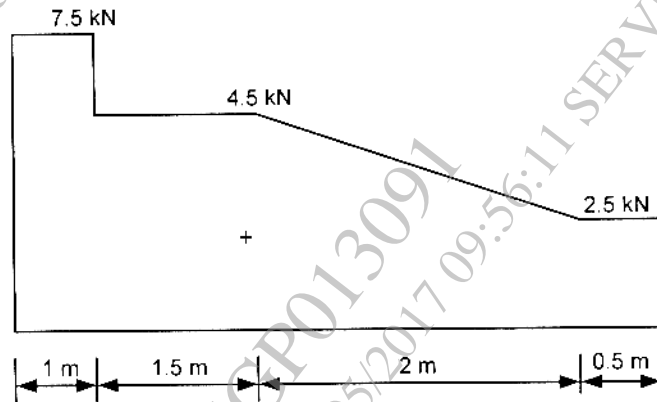(b) Draw the loading diagram and bending moment diagram from the given shear force diagram of a beam. [6]
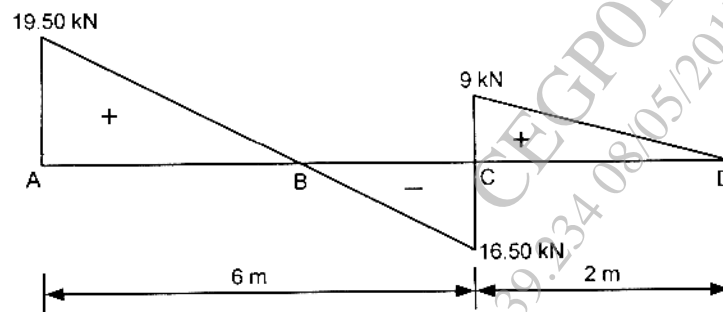
6. (*a*) Draw Shear Force Diagram and Bending Moment Diagram of a simply supported beam as shown in figure. [7]

(*b*) Construct loading diagram for the following shear force diagram for a beam as shown in fig. [6]

7. (*a*) Calculate the safe compressive load on hollow C.I. Column with one end fixed and other end hinged. The column having a 150 mm external diameter and 100 mm internal diameter and 10 m length. Use Euler's Formula with factor of safety 5. Take E = 95×10^3 N/mm². [6]

(*b*) A hollow C.I. column whose outside diameter is 250 mm has a thickness of 15 mm. It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety 4. Calculate slenderness ratio & Rankine's critical load. Take σ_c = 550 N/mm², $a = \dfrac{1}{600}$ & Take E = 9.4 $\times 10^4$ N/mm². [7]

Or

8. (*a*) A rectangular column of 240 mm × 150 mm is subjected to a vertical load of 10 kN placed at an eccentricity of 60 mm in a plane bisecting 150 mm side. Determine the maximum & minimum stress intensities in the section. [6]

(*b*) A masonry pillar 8 m high is 1.5 m × 2.5 m in section, a horizontal wind pressure of 1.4 kN/m² acts on the 2.5 m × 8 m face. Find the maximum and minimum stress intensities induced on the base section. The weight of masonry is 22.5 kN/m³. [7]