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

Seat No.	

[5152]-102

S.E. Civil (First Semester) EXAMINATION, 2017
STRENGTH OF MATERIAL
(2012 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.

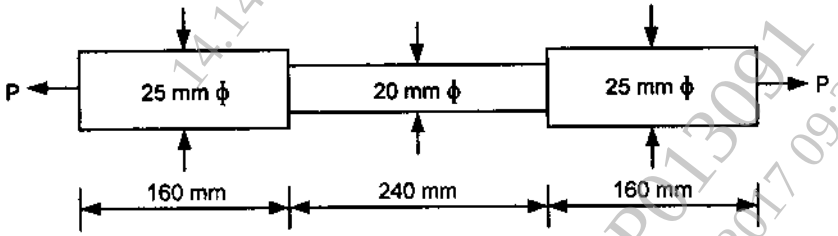
(*iii*) Figures to the right indicate full marks.

(*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. (Fig given below). [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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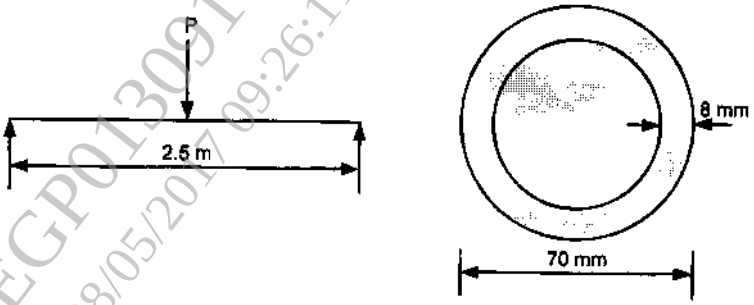
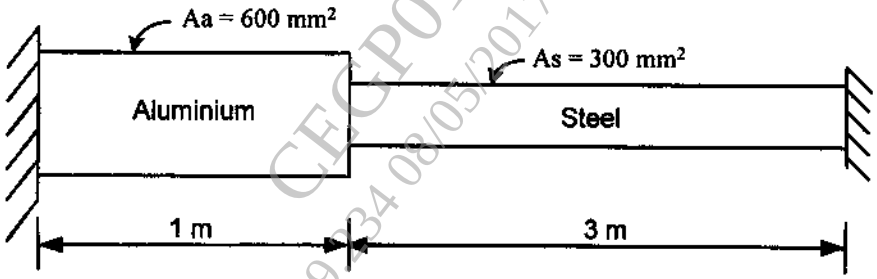
be applied at the centre of the span if the permissible stress in the tube is 150 N/mm². (Fig. given below). [6]



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, α_a = 11 × 10⁻⁶/ºC and α_s = 12 × 10⁻⁶/ºC. [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]

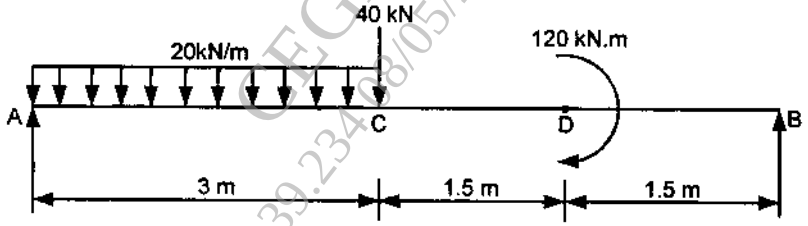
(*b*) At a point in a beam the normal stress along the length is 80 N/mm². The stress at that point is positive magnitude of 35 N/mm². Find the stresses on a plane whose normal is inclined at 30° to the longitudinal axis. Also find the principal stresses and planes on which they act. [6]

Or

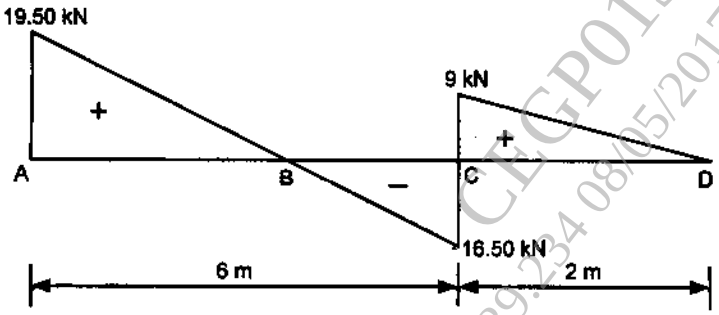
4. (*a*) A load of 500 N falls freely through a height of 150 mm on to a collar attached to the end of a vertical rod of 50 mm diameter and 2 m long, the upper end of the rod being fixed to the ceiling. Calculate the maximum instantaneous extension of the bar and also calculate the maximum stress in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

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

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

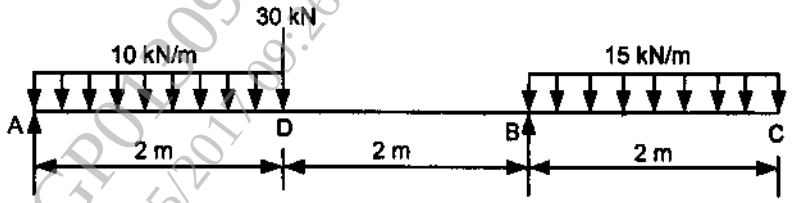


(*b*) Draw the loading diagram & bending moment diagram from the given shear force diagram of a beam as shown in figure below. [6]

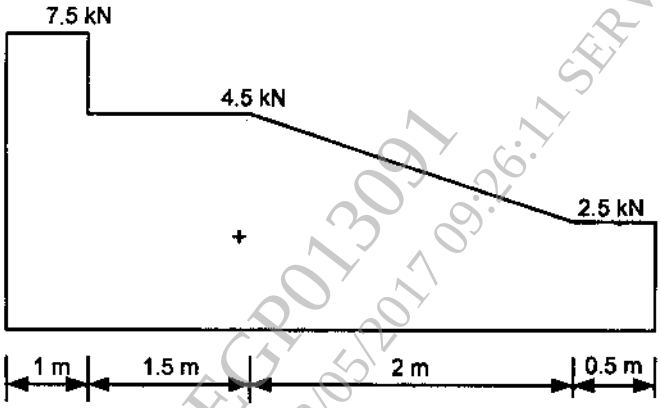


Or

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



(*b*) Construct loading diagram for the following shear force diagram for a beam as shown in Fig. below. [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 $E = 95 \times 10^3$ N/mm^2. [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 and Rankine's critical load. Take $\sigma_c = 550$ N/mm^2, $a = \frac{1}{1600}$ and Take $E = 9.4 \times 10^4$ N/mm^2. [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/m^2 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/m^3. [7]