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[5668]-115

S.E. (Mechanical/Sandwich/Automobile) (First Semester)
EXAMINATION, 2019

STRENGTH OF MATERIALS
(2015 PATTERN)

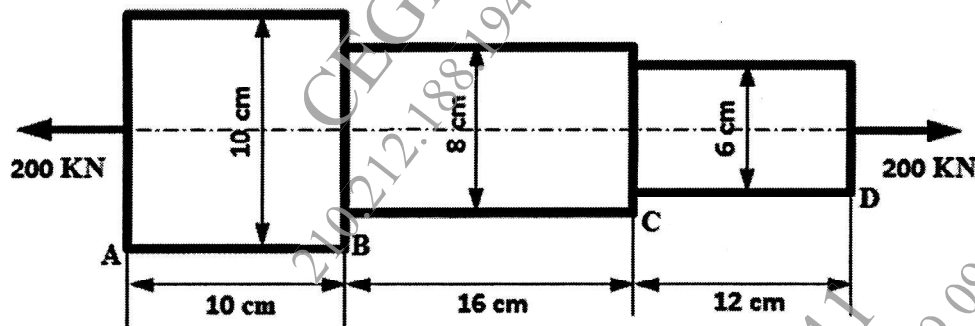
Time : 2 Hours

Maximum Marks : 50

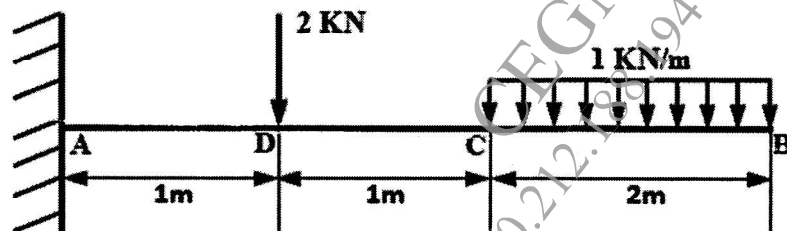
Instructions to the candidates :

- 1) Answer questions Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks
- 4) Use of electronic pocket calculator is allowed
- 5) Assume suitable data, if necessary.

- Q.1 (a) Find the total elongation of a steel bar as shown in figure, subjected to an axial load of 200 kN. Take $E = 200 \text{ GPa}$. [06]



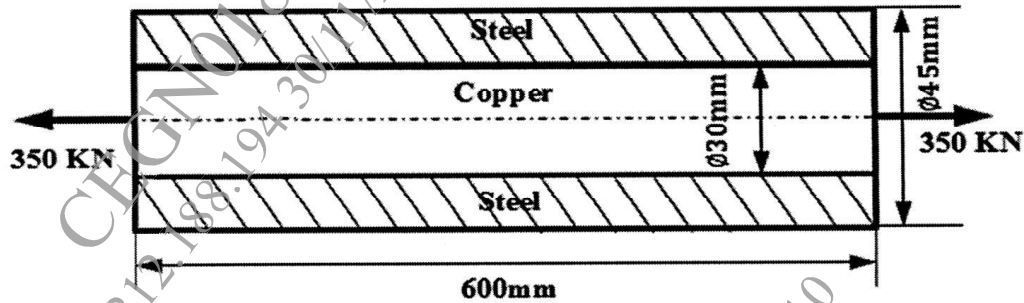
- (b) Draw bending moment and shear force diagram of a cantilever beam AB 4m long [06] having its fixed end at A and loaded with a uniformly distributed load of 1 kN/m upto 2m from B and with a concentrated load of 2 kN at 1m from A as shown in figure.



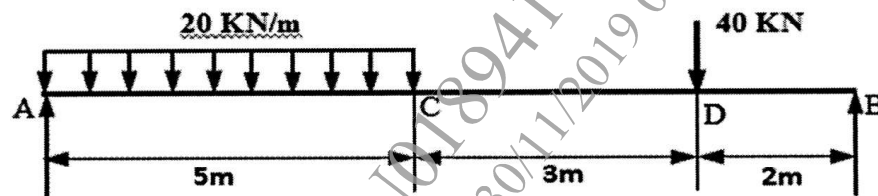
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OR

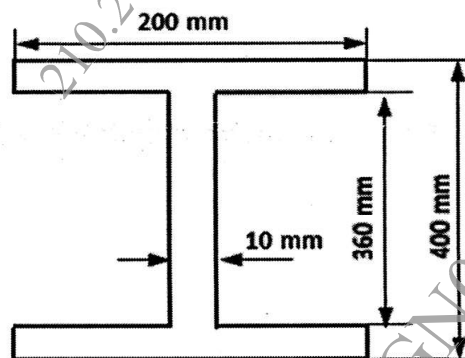
- Q.2 (a) A copper rod of 30 mm diameter and 600 mm long is enclosed in a steel tube of internal diameter 30 mm and external diameter 45 mm. Bar is subjected to load of 350 kN as shown in figure. Calculate load shared by each material and also elongation of bar if $E_{\text{Copper}} = 105 \text{ GPa}$ and $E_{\text{Steel}} = 210 \text{ GPa}$. [06]



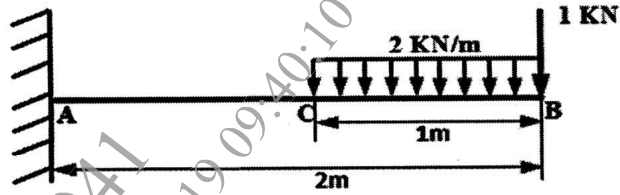
- (b) A simply supported beam AB is loaded as shown in figure. Draw S.F.D and B.M.D indicating maximum bending moment and determine its value. [06]



- Q.3 (a) A rolled steel joist of I-section has the dimensions as shown in figure. The beam of I-section carries a U.D.L of 40 kN/m run on a span of 10 m. Calculate the maximum stress produced due to bending. Also draw bending stress distribution the depth of section.. [06]

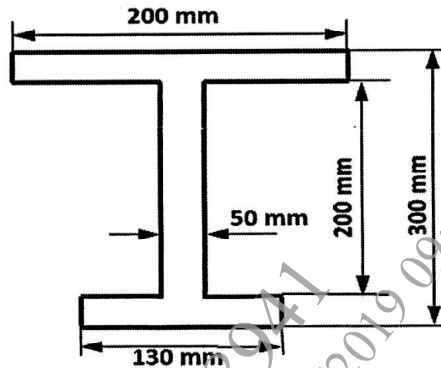


- (b) A Cantilever 10 cm wide and 20 cm deep projects 2 m from a wall into which it is cast. The cantilever carries a U.D.L of 2 kN/m over a length of 1 m from the free end and a point load of 1 kN at the free end and a point load of 1 kN at the free end. Find the slope and deflection at the free end. Take $E = 210 \text{ GPa}$. [06]

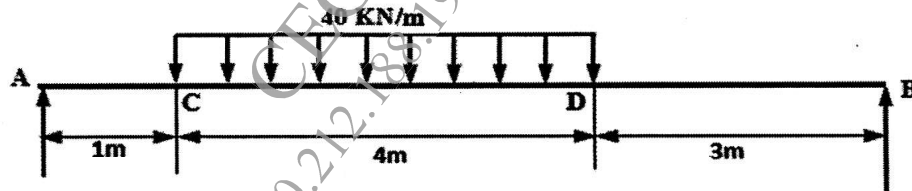


OR

- Q.4 (a) The shear force acting on a beam at an I-section with unequal flanges is 50 kN. The section as shown in figure. The moment of inertia of the section about N.A. is $2.849 \times 10^8 \text{ mm}^4$. Calculate shear stress at the N.A. and also draw the shear stress distribution over the depth of section. [06]



- (b) A beam of length 8 m is simply supported at its ends. It carries a uniformly distributed load of 40 kN/m as shown in figure. Determine the deflection of the beam at its mid-point and also the position and magnitude of maximum deflection. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 4.3 \times 10^8 \text{ mm}^4$. [06]



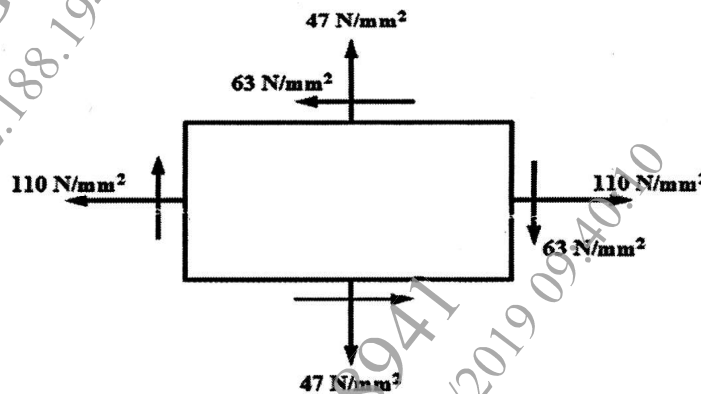
- Q.5 (a) A hollow shaft, having an inside diameter 60% of its outer diameter, is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in material, if material to be used is also the same. [06]
 (b) A hollow mild steel tube 6m long 4cm internal diameter and 5mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take $E = 2 \times 10^5 \text{ N/mm}^2$. [07]

OR

- Q.6 (a) Determine the diameter of a solid shaft which will transmit 300 kw at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2m. Take modulus of rigidity $= 1 \times 10^5 \text{ N/mm}^2$. [06]
 (b) A hollow cylindrical cast iron column is 4m long with both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 250 kN with a factor of safety of 5. Take the internal diameter as 0.5 times the external [07]

diameter. Take crushing stress $\sigma_c = 550 \text{ N/mm}^2$ and value of Rankine's constant, $a = \frac{1}{1600}$ in Rankine formula.

- Q.7 (a)** A rectangular block is subjected to tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former one. Each of the above stress is accompanied by a shear stress of 63 N/mm^2 and its direction as shown in figure. Using analytical approach, Find: [07]
- The direction and magnitude of major and minor principal stress.
 - Magnitude of the greatest shear stress.



- (b)** Determine the diameter of a bolt which is subjected to an axial pull of 9 kN together with a transverse shear force of 4.5 kN using Maximum Principal stress theory. [06]
Given the elastic limit in tension = 225 N/mm^2 , Factor of Safety = 3 , Poisson's ratio = 0.3 .

OR

- Q.8** A point in a strained material is subjected to stress as shown in figure. Using Mohr's circle method (without using any analytical approach). Determine: [13]
- Direction and magnitude of major and minor principal stress.
 - Magnitude of greatest shear stress
 - The normal and tangential stresses across the oblique plane AM
- Draw the Mohr's circle only in Graph Paper with suitable scale factor.

