Total No. of Questions : 4]

SEAT No. :

PA-47

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S.E. (Automobile & Mechanical Engineering/Mechanical Sandwitch/Automation & Robotics)

SOLID MECHANICS

(2019 Pattern) (Semester - I) (202041)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Figures to the right side indicate full marks.***
3) ***Use of electronic pocket calculator is allowed.***
4) ***Assume Suitable data if necessary.***

Q1) a) A 2.0 m long steel bar is having uniform diameter of 40 mm for a length of 1 m from one end. For the next 0.5 m length the diameter decreases uniformly to '*d*'. For the remaining 0.5 m length it has a uniform diameter of d mm. When a load of 150 *k* N is applied, the observed extension is 2.40 mm. Determine the diameter *d*. Take modulus of elasticity for steel equal to 200 *k* N/mm^2. **[7]**

b) The composite bar consisting of steel and aluminium components as shown in Fig 1.1 is connected to two grips at the ends at a temperature of 60º C. Find the stresses in the two rods when the temperature falls to 20ºC. **[8]**

i) if the ends do not yield.

ii) if the ends yield by 0.25 mm.

Take $E_s = 2 \times 10^5$ and $E_a = 0.7 \times 10^5$ N/mm^2, $\alpha_s = 1.17 \times 10^{-5}$ and $\alpha_a = 2.34 \times 10^{-5}$ per °C. The areas of steel and aluminium bars are 250 mm^2 and 375mm^2 respectively.

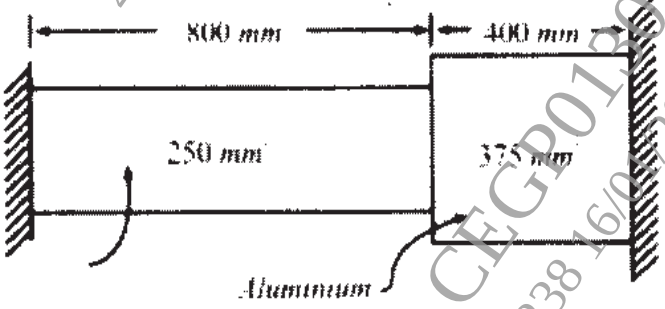

Fig 1.1

OR

P.T.O.

Q2) a) A steel block 360mm×80mm×160 mm is subjected to the following forces. **[7]**

i) A tensile force of 1280KN on the 160mm×80mm faces (take as a X - direction).

ii) A tensile force 3456 KN the 360mm×80mm faces (take as a Y - direction) and.

iii) A compressive force of 5184KN on the 160mm×360mm faces (take as a Z - direction).

Find the changes in the dimensions of the block and also the change in volume. Take E = 2×10^5 N/mm^2 and 1/m = 0.25.

b) A rigid rod ABCD is supported by a hinge at A and two wires at B and C as shown in figure 2.1. Determine the stresses and elongation of the two wires. Take E_s = 200 GPa and E_c =100GPa. **[8]**

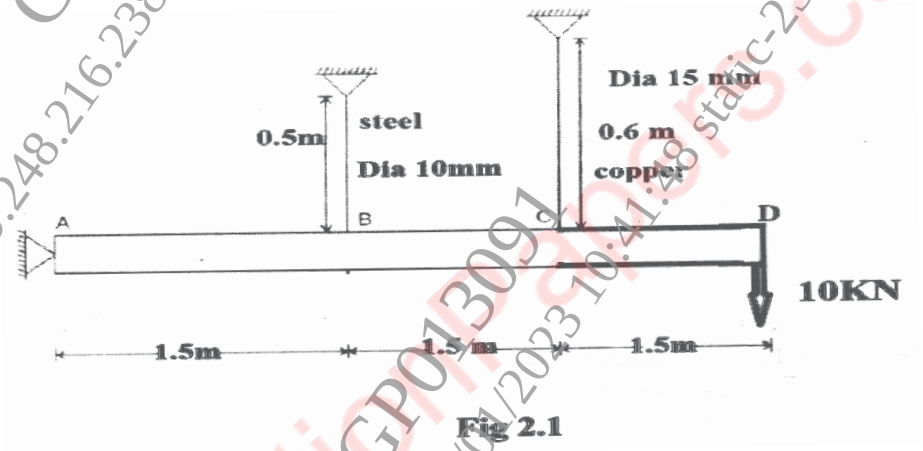

Fig 2.1

Q3) a) Draw SFD and BMD of the beam shown in figure 3.1 **[7]**

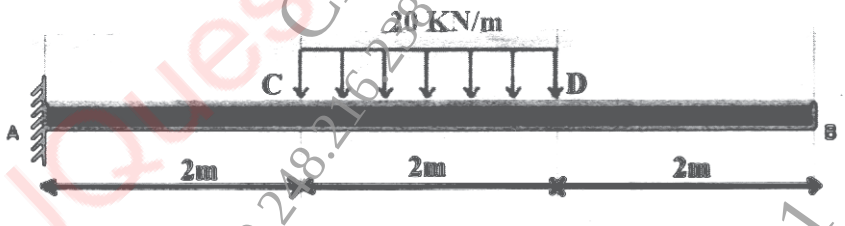

Fig 3.1

b) Draw SFD & BMD of the beam shown in figure 3.2, also locate the point of contraflexure from left end. **[8]**

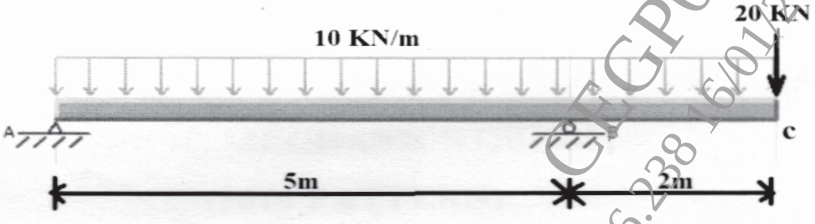

Fig 3.2

OR

Q4) a) Draw SFD & BMD of the beam shown in figure 4.1. **[7]**

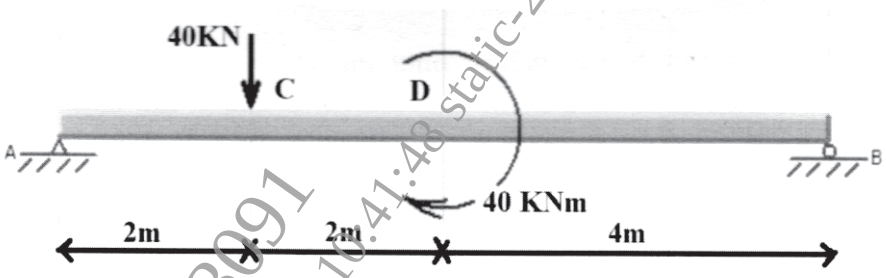

Fig 4.1

b) Draw SFD & BMD, of the beam shown in figure 4.2, also find the POC from left end. **[8]**

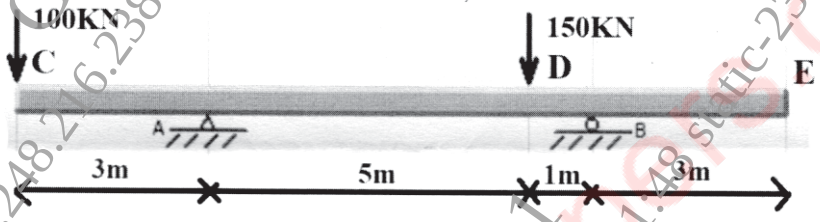

Fig 4.2

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