CO5

Sanjay Ghodawat University, Kolhapur

2018-19

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Year and Program:2018-19 **School of Technology** **Department: SY B.Tech. Aeronautical Engineering**

Course Code: AET208 **Course Title: Mechanics of Materials** **Semester – IV**

CO3

Day and Date: Tuesday 28-05-2019 **End Semester Examination (ESE)** **Time:** 10.30 am to 1.30 pm **Max Marks: 100**

Instructions:
1) All questions are compulsory.
2) Assume suitable data wherever necessary.
3) Figures to the right indicate full marks.

		Marks	Bloom's Level	CO
Q.1				
a)	Explain typical stress strain curve for ductile material.	07	L_2	CO1
b)	A stepped bar is made of two different materials. Material 1 has Young's modulus 2 x 10^5 N/mm^2 while that of material 1 is 2 x 10^5 N/mm^2. Find the extension of the bar under a tensile load of 25 kN with area of material 1 is 800 mm^2 and area of material 2 is 600 mm^2. Take length of material 1 and 2 as 500 mm and 750 mm.	08	L_3	CO2
	OR			
b)	A bar of 800mm length is attached rigidly at A and B as shown in Fig. Q1 (b) along with some forces acting along the bar axis. If Young's modulus is 200 GPa, determine the reactions at the ends, by taking the diameter as 25mm. Also, compute the stresses and change in length of each portion.	08	L_3	CO2

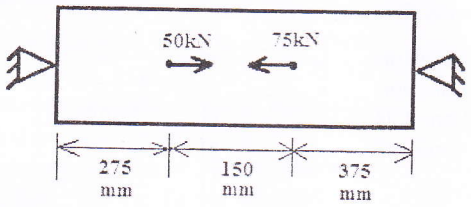

Fig. Q1(b)

Q.2 a)	Draw Shear force diagram and bending moment diagram for a simply supported beam carrying UDL for its entire length.	07	L_2	CO2
b)	Draw Shear force diagram and bending moment diagram for an overhanging beam shown in Fig. Q2(b)	08	L_3	CO2

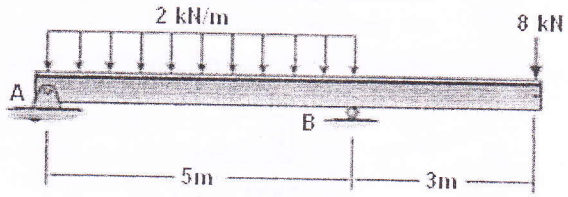

Fig. Q2(b)

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OR

(b) The rigid block of mass M is supported by the three symmetrically placed rods. The ends of the rods were level before the block was attached. Determine the largest allowable value of M if the properties of the rods are as listed (σ_w is the working stress). Ref fig Q2(c)

	E (GPa)	A (mm^2)	σ_w (MPa)
Copper	120	900	70
Steel	200	1200	140

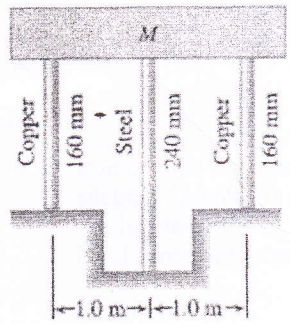

Fig. Q2(b)

08 L_3 CO2

Q.3 **Solve any Two**

a) Derive bending equation with usual notations. 08 L_2 CO3

b) Draw the shear stress variation diagram for the I-section shown in Fig. 3(b) when it is subjected to a shear force of 100 kN.

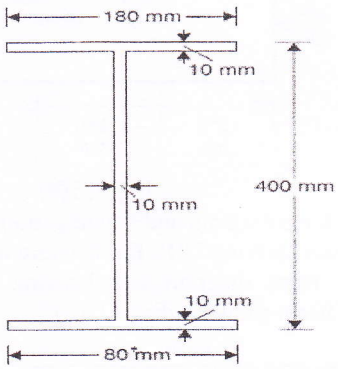

Fig. Q3 (b)

08 L_2 CO3

ESE

c) A state of stress at a point in a strained material is as shown in Figure. Compute by analytical method i) Direction of principal planes; ii) Magnitudes of principal stresses; iii) Magnitude of maximum shear stress and its direction.

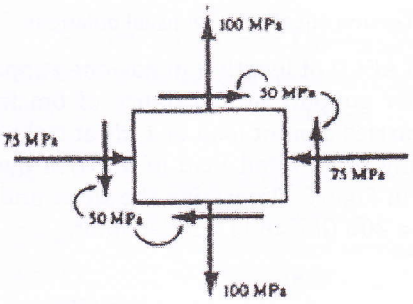

Fig. Q3 (c)

08 L_2 CO3

Q.4 **Solve any Two**

a) Derive maximum slope and deflection equation when a cantilever beam is subjected to UDL over its entire length. 09 L_3 CO3

b) Determine the dimensions of a hollow shaft with a diameter ratio 3:4 which is to transmit 60 kW at 200 rpm. Take τ=70 MN/m^2 and θ=3.8^0 in a length of 4 m. Use G = 80 GN/m^2. 09 L_3 CO5

c) A beam of length 14 m is simply supported at its ends and carries two point loads of 90 kN and 60 kN at a distance 3 m and 9.5 m, respectively, from the left support. Find (i) deflection under each load, (ii) maximum deflection and (iii) the point at which maximum deflection occurs. Given E = 2.1 $\times 10^5$ N/mm^2 and I = 64 $\times 10^8$ mm^4. Use MeCaulay's method. 09 L_3 CO3

Q.5 **Solve any two**

a) Derive deflection equation with usual notations. 09 L_3 CO3

b) A hollow shaft is to transmit 300 kW power at 80 rpm. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter is 0.6 times the external diameter. Find the internal and external diameters assuming the maximum torque is 1.4 times the mean. 09 L_3 CO5

c) A 1.5 m long column has a circular cross section of 50 mm diameter with one end fixed and other if free. Taking factor of safety 3, determine the safe load using i) Euler's formulae and ii) Rankine's formulae. Use E=120 GPa, σ_c=560 N/mm2, and a =1/1600 09 L_3 CO4

Q.6 **Solve any two**

a) A solid circular shaft and a hollow circular shaft whose inside diameter is ¾ of the outside diameter are of same material, of equal length, and are required to transmit a given torque. Compare the weights of these two shafts if the maximum shear stress developed in the two shafts is equal. 09 L_2 CO5

b) A solid round bar 3 m long and 50 mm in diameter is used as a strut with following end conditions i) one end is fixed and the other end is free ii) Both ends are hinged. Determine the crippling load. Take E= 2 x 10^5 N/mm^2. 09 L_3 CO4

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c) Derive Torsion equation with usual notations. 09 L_2 CO5

d) A beam ABCD of length 9 m has one support at the left end and the other support at a distance of 6m from the left end. The beam carries a point load of 1 kN at right end and also carries a uniformly distributed load of 4 kN/m over a length of 3 m as shown in Figure. Determine the slope and deflection at point C. Take E = 200 GPa and I = $5x10^8$ mm^4. 09 L_3 CO3

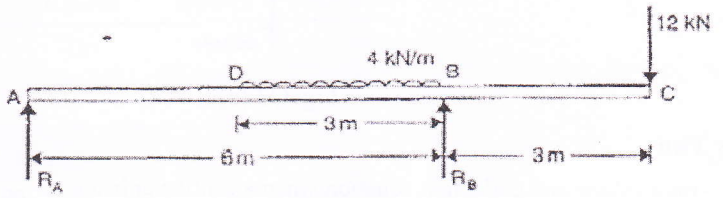

Fig. Q6 (c)

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