U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

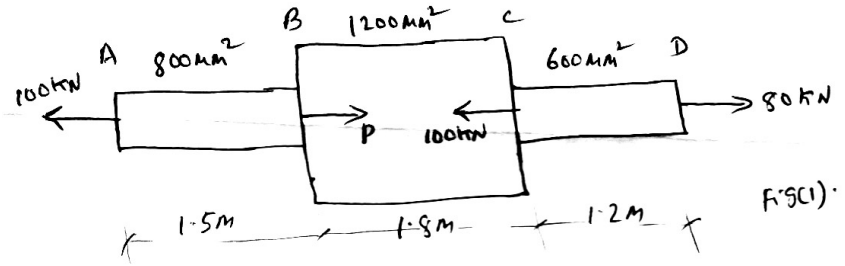
Third Semester, B.E. - Automobile Engineering

Semester End Examination; Dec. - 2019

Mechanics of Materials

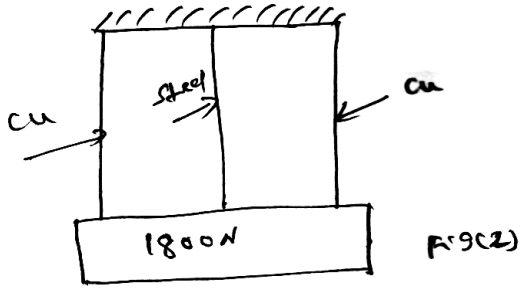
Time: 3 hrs *Max. Marks: 100*

Note: I) **PART - A** is compulsory. One question for 2 marks from each unit.
II) **PART - B**: Answer any **two** sub questions (from a, b, c) for Maximum of 18 marks from each unit.

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	Define: i) Hook's law ii) factor of safety.	2
b.	What is the principle of superposition?	2
c.	What are Sagging bending moment and Hogging bending moment?	2
d.	List the assumption made in theory of pure tension.	2
e.	Define slenderness ratio.	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	A member ABCD is subject to faces as shown in Fig. 1. Evaluate the stresses induced on the various elements and the net changes in the length of the member. Take E = 210 GPa 	9
b.	A bar of certain material 30 mm diameter is subjected to a pull of 75 kN the measured elongation on a gauge length of 220 mm is 0.10 mm and a change in diameter is 0.0042 mm. Calculate Poisson's ratio, Young's Modulus, Shear modules and Bulk Modules.	9
c.	Derive the equation of relationship between Young's modules and rigidity modulus.	9
	UNIT - II	**18**
2 a.	A 15 mm diameter steel rod passes centrally through a copper tube 50 mm external diameter and 40 mm internal diameter the tube is closed at each end by rigid plates of negligible thickness the nuts are tightened on the projecting parts of the rod. If the temperature of assembly is raised by 60°C, calculate the stresses developed in copper and steel Take: E_S = 210 GPa, E_C = 105 GPa, $\alpha_S = 12x10^{-6}/°C$, $\alpha_C = 17.5x\ 0^{-6}/°C$	9

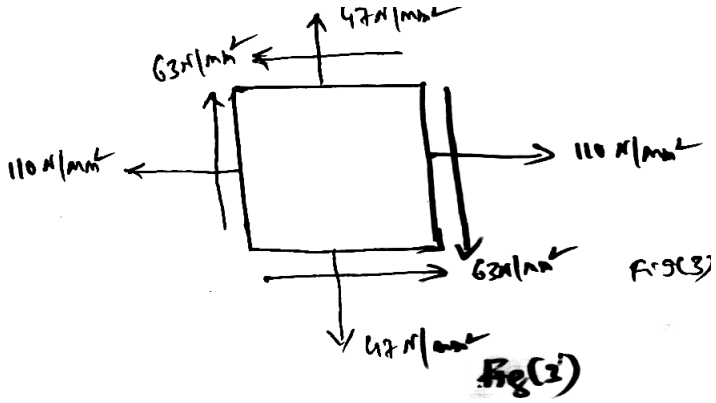
Contd…2

b. Three wires as shown in Fig. (2) are supporting a load of 1800 N the cross sectional area of each wire is 10 mm^2. If the length of the wire are so adjusted as to share the loads equally at 20°C. Find the stresses in wires at 75°C. Take $E_S = 2\times10^5$ N/mm^2, $E_C = 10^5$ N/mm^2, $\alpha_S = 12\times10^{-6}$ /°C, $\alpha_C = 18\times10^{-6}$ /°C. 9



Fig(2)

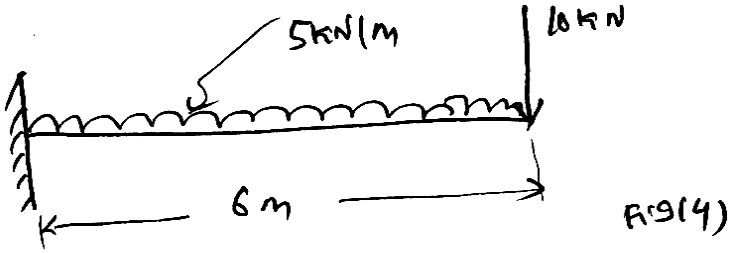
c. A rectangular block of a material is subjected to tensile stress of 110 N/mm^2 in one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the farmer as shown in Fig.(3) the above stress is accompanied by shear stress of 63 N/mm^2. Find the direction and magnitude of each principal stresses and magnitude of maximum shear stress and sketch the planes and mark the stresses on the planes. 9



Fig(3)

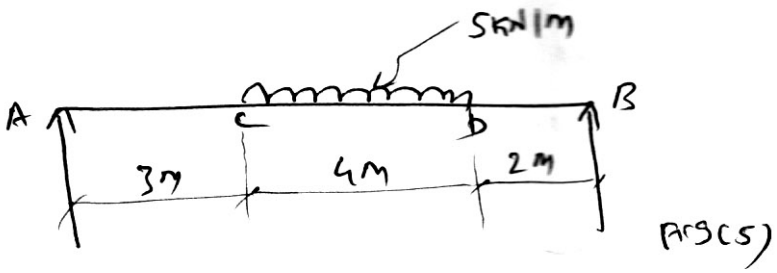
UNIT - III **18**

3 a. Draw SFD and BMD for a cantilever subjected to UDL and point load as shown in Fig.(4). 9



Fig(4)

b. Construct SFD and BMD for a simply supported beam carrying UDL as shown in Fig.(5) 9



Fig(5)

Contd...3

c. Derive the equations of relations ship between shear force bending moment and loading intensity — 9

UNIT - IV — **18**

4 a. A simple supported beam of span 10 m is loaded with a central point load of 50 kN the cross section of the beam is rectangle 200 mm wide and 300 mm deep at a cross section distance 3 m from the support. Calculate the bending and shear stress at 100 mm and 150 mm above the neutral area of the section. — 9

b. Derive the slope and defection equation for cantilever length '*l*' calling a point load at the free end. — 9

c. A rolled steel beam having a span of 6 m carries a point load of 40 kN at 4 m from the left support. Find the defection under the load and the position and amount of maximum defection. Take I_α for the section = 7.33×10^7 mm^4 and E = 200 kN/mm^2. — 9

UNIT - V — **18**

5 a. A hallow circular shaft has to transmit 60 kW at 210 rpm slab that the max shear stress does not exceed 60 mN/m^2. If the ratio of the internal to external dia is equal to ¾ and the value of rigidity modulus = 84 GPa. Find the dimensions of the shaft and the angle of twist in a length of 3 m. — 9

b. A mild steel tube 6 m long and 40 mm internal diameter and 4mm thick are used as a strut. Find the collapsing load when,

i) Both ends are hinged — 9

ii) One end is fixed and the other end is hinged

Take; $E = 2.1 \times 10^5$ N/mm^2.

c. A thick cylindrical pipe of outside dia 300 mm and thickness of metal 60 mm is subjected to an internal fluid pressure of 40 MPa. Determine the maximum and minimum intensities of hoop stress and radial stresses induced in the pipe section plot the hoop and radial stresses induced. — 9

* * *