Sanjay Ghodawat University, Kolhapur
Established as State Private University under Govt. of Maharashtra. Act No XL, 2017
2018-19
EXM/P/09/01

Year and Program:2018-19 **School of Technology** **Department of Mechanical Engineering**

Course Code: MET209 **Course Title: Strength of Materials** **Semester – III**

Day and Date Friday 14-06-2019 **End Semester Examination (ESE)** **Time:** 3Hrs. 2.30 to 5.30 PM. **Max Marks: 100**

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

Q.1	Marks	Bloom's Level	CO
a) Define	06	L_2	CO1

i. Volumetric Strain
ii. Youngs Modulus
iii. Poisson's Ratio
iv. Factor of Safety
v. Modulus of Rigidity
vi. Bulk Modulus

OR

A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in fig 1a. Calculate the force P3 necessary for equilibrium if P_1= 120kN, P_2= 22kN and P_4= 160kN. Determine also the net change in length of the member. Take E=2x10^5 N/mm^2 — 06 — L_3 — CO1

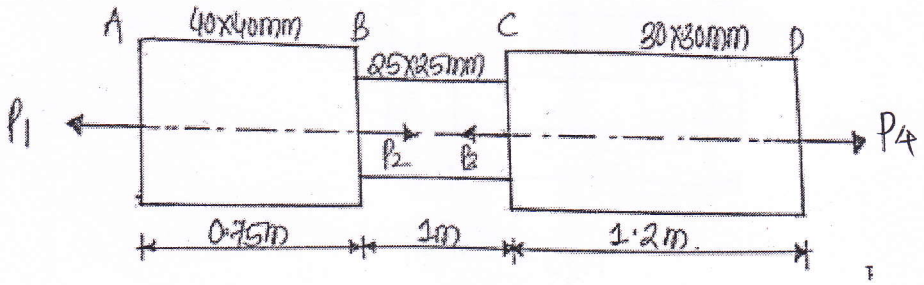

Fig.1a.

ESE

b) Derive the expression for normal stress & tangential stress on any oblique section of a body subjected to direct stress in two mutually perpendicular directions. 09 L_3 CO2

OR

At a point within a body subjected to mutually perpendicular directions, the stresses are 80N/mm^2 tensile and 40N/mm^2 tensile. Each of the above stresses is accomplished by shear stress of 60 N/mm^2. Determine the normal stress, shear stress and resultant stress on an oblique plane inclined at an angle of 45° with the axis of minor tensile stress. 09 L_3 CO2

Q.2 Draw the shear force & bending moment diagram for the beam as show in in fig. 2a. Also find the point of contraflexure if any, 16 L_3 CO3

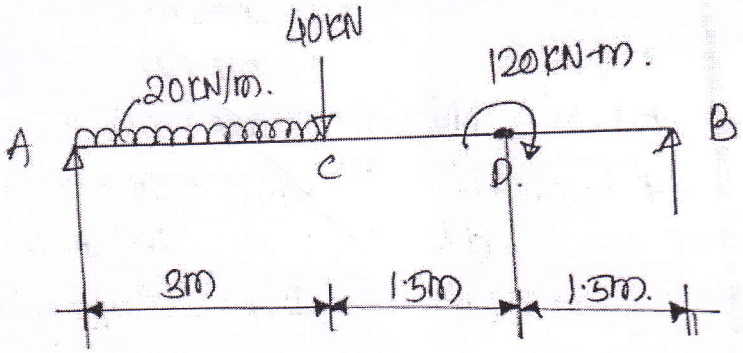

fig. 2a

Q. 3 If the shear force acting on the I section beam as shown in fig. 3 is 40kN, find the maximum shear stress developed in the I section. Also calculate the Shear Stresses at Neutral axis & also draw the shear stress distribution over the depth of the section. 15 L_3 CO4

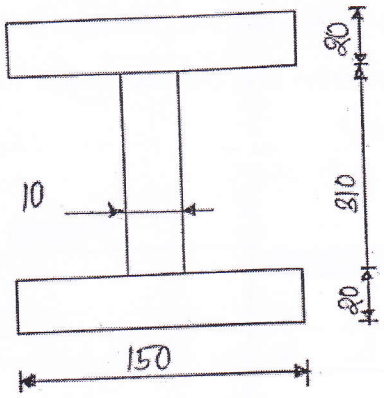

Fig 3

All Dimensions are in mm

ESE

Q.4 **Solve any Two**

a) Derive the expression for slope & deflection of simply supported beam subjected to central point load. 09 L_2 CO5

b) A cantilever of length 'l' carries a uniformly distributed load of w/unit length over the span of the beam. Derive the relations for the slope of deflections for at free end. Use double integration method 09 L_2 CO5

c) Find the deflection at C in the beam loaded as shown in fig 4c, Take EI= 10,000kN-m^2 09 L_2 CO5

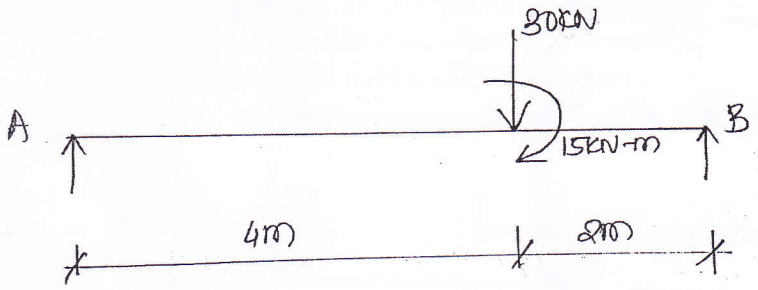

fig 4c.

Q.5 **Solve any Two**

a) Derive the expression for the Euler's crippling load for long column with both the ends are hinged. 09 L_3 CO6

b) The cross section of the column is as shown in fig 5b. Calculate the length of the member for which crippling load by Euler's formula and Rankine formula will be same. Assume yield stress to be 330Mpa, E=210GPa, I_{xx}= 24.2x$10^6$$mm^4$, I_{yy}= 3x$10^6$$mm^4$& Rankines constant a as $a = \frac{1}{7500}$ 09 L_3 CO6

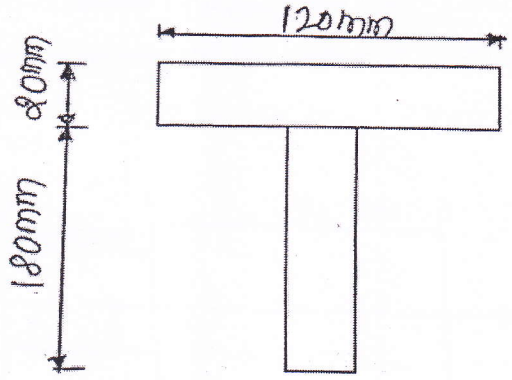

fig 5b

ESE

c)	A hollow circular shaft of 6m length and inner and outer diameters of 75mm and 100mm is subjected to a torque of 10kN-m. If G=80Gpa, Determine the maximum shear stress produced and the total angle of twist.	09	L_3	CO6
Q.6	**Solve any Three**			
a)	Determine the maximum deflection for the beam shown in fig 6a, by double integration method. Take EI=36000kN-m^2	06	L_3	CO5

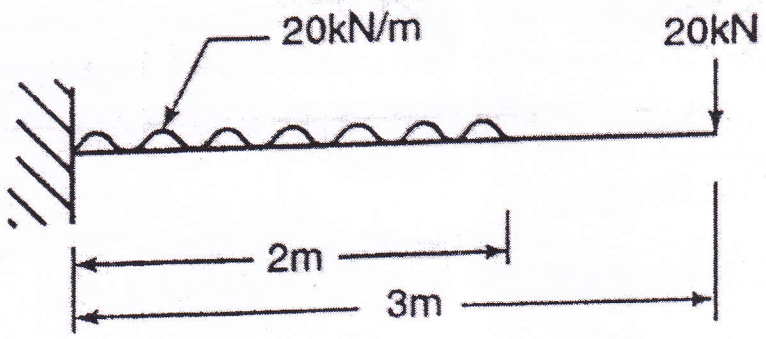

fig. 6a

b)	State the assumptions made in pure torsion	06	L_2	CO6
c)	Derive the torsional equation for the shaft L, radius R fixed at one end & subjected to torque T at the other end	06	L_2	CO6
d)	Explain the various end conditions and corresponding equivalent lengths of columns.	06	L_2	CO6

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