Ref. No. EX/CON/T/213/2019

B. E. CONSTRUCTION ENGINEERING 2ND YEAR 1ST SEM EXAM - 2019

SUBJECT: STRENGTH OF MATERIALS

Time : Three Hours **Full Marks : 100**

Part I

	Question No.		Marks
CO1 [02]	Q1.i)	The relation between Modulus of Elasticity E, Shear Modulus G and Bulk Modulus K is a) $K=\frac{3E}{(1+2\mu)}$ b) $K=\frac{E}{3(1+2\mu)}$ c) $K=\frac{E}{3(1-2\mu)}$ d) $K=\frac{3E}{(1-2\mu)}$	01
	Q1.ii)	A vertical rod PQ of length L is fixed at its top end P and has a flange fixed at the bottom end Q. A weight W is dropped vertically from a height h (<L) on the flange. The axial stress in the rod can be reduced by a) Increasing the length of the rod b) Decreasing the length of the rod c) Decreasing the area of cross section of the rod d) Increasing the modulus of elasticity of the material	01
CO2 [02]	Q1.iii)	The major and minor principal stresses at a point are 4MPa and (-) 4MPA respectably. The maximum shear stress at the point is a) Zero b) 4MPa c) 8 MPa d) 16 MPa	01
	Q1.iv)	An element of a stressed body is in a state of pure shear with a magnitude of 50N/mm². The magnitude of maximum principal stress at that location is a) 50 N/mm² b) 25N/mm² c) 100N/mm² d) 75N/mm²	01
CO4 [01]	Q1.v)	The maximum shear stress in a solid shaft of circular cross-section having diameter d subjected to a torque T is τ . If the torque is increased by four times and the diameter of the shaft is increased by two times, the maximum shear stress in the shaft will be a) 2τ b) τ c) $\tau/4$ d) $\tau/2$	01

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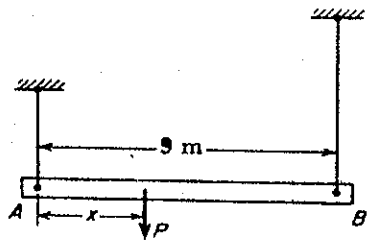
Time : Three Hours **Full Marks : 100**

Part I

	Question No.		Marks
CO1 [18]		**Answer any two from question 2a, 2b and 2c in this block**	
	Q2a.	A circular bar of 50mm dia and 250mm length is subjected to a pull of 50kN. The elongation in length of the bar is recorded as 0.0318mm and the reduction in diameter is 0.0019mm. Calculate Modulus of Elasticity, Poisson's ratio, Bulk modulus and Shear modulus.	09
	Q2b.	A rigid bar AB, 9m long, is suspended by two vertical rods at its ends and hangs in a horizontal position under its own weight as shown in Fig.A. The rod at A is brass, length 3m, cross-sectional area, 1000mm², modulus of elasticity, 1 x 10^5 N/mm². The rod at B is steel, length 5m, cross-sectional area, 445 mm², modulus of elasticity 2 x 10^5 N/mm². At what distance x from A may a vertical load P be applied if the bar is to remain horizontal after the load is applied ?  Fig.A	09
	Q2c.	For a prismatic bar of length L and cross sectional area A, which hangs vertically under its own weight, derive the expressions for (i) total elongation of the bar (ii) strain energy stored in the bar if its weight per unit volume is γ.	09

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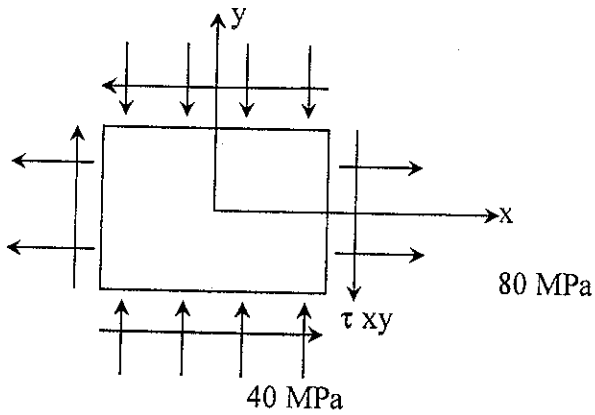
B. E. CONSTRUCTION ENGINEERING 2ND YEAR 1ST SEM EXAM - 2019

SUBJECT: STRENGTH OF MATERIALS

Time : Three Hours **Full Marks : 100**

Part I

	Question No.		Marks
CO2 [18]		**Answer any two from question 3a, 3b and 3c in this block**	
	Q3a.	For the rectangular element shown in Fig.B the following data are given σ_x = 80 MPa σ_y = (-)40MPa  Fig.B If the maximum principal stress is limited to 100 MPa (Tensile), find the shear stress that may be allowed on the element. Determine the maximum principal stress and maximum shear stress. Find the directions in which maximum principal stress acts.	09
	Q3b.	A compound bar consists of a circular rod of steel of diameter 20mm, rigidly fitted into a copper tube of internal diameter 20mm and thickness 2.5mm. If the bar is subjected to an axial load of 80KN, find the stress developed in the two materials. Given $E_s = 2x10^5$ N/mm² and $E_c = 1.2 \times 10^5$ N/mm²	09
	Q3c.	A steel bar 30mm in diameter is rigidly attached to two parallel supports which are 4.0m apart. Find the pull exerted by the bar on the support when the temperature is increased to 50°C if a) The supports do not yield b) Yielding of support is 1mm Assume $\alpha = 12 \times 10^{-6}$ per °C; $E_s = 2 \times 10^5$ N/mm²	09

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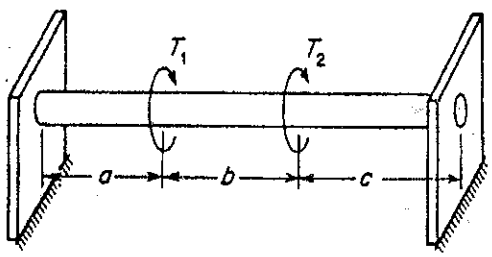
B. E. CONSTRUCTION ENGINEERING 2ND YEAR 1ST SEM EXAM - 2019

SUBJECT: STRENGTH OF MATERIALS

Time : Three Hours **Full Marks : 100**

Part I

	Question No.		Marks
CO4 [09]		**Answer any one from question 4a and 4b in this block**	
	Q4a.	A hollow aluminum tube used in a roof structure has an outside diameter of 100 mm and an inside diameter of 80 mm. The tube is 2.50m long. Assume G = 28 GPa a) If the tube is twisted in pure torsion by torques acting at the ends, what is the angle of twist when the maximum shear stress is 50 MPa? b) What diameter is required for a solid shaft to resist the same torque with the same maximum stress?	09
	Q4b.	A Prismatic shaft of diameter d has built-in ends and is subjected to the action of externally applied twisting moments T_1 and T_2 as shown in Fig.C. Find the internal torques T_a, T_b, T_c in the three portions a, b, c of the shaft. The following numerical data are given a =750mm, b=1250mm, c=1000mm, T_1=1200 N-m and T_2=2400 N-m  Fig.C	09

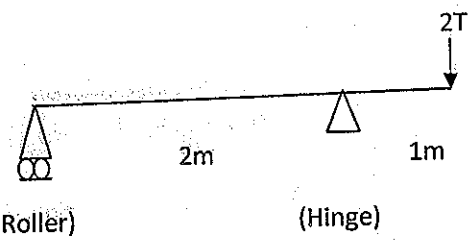
Bachelor of Construction Engineering 2nd yr, 1st Semester,2019

Part-II

Strength of materials

Ref: Ex/CON/T/213/2019 Sub code :CON/T/213

4.CO3: i) Define Bending Moment & Shear Force. Deduce the relation between :
a) Bending moment & Shear force b) Shear force & load.
ii) Draw SFD & BMD for the following : 4+3+3+10

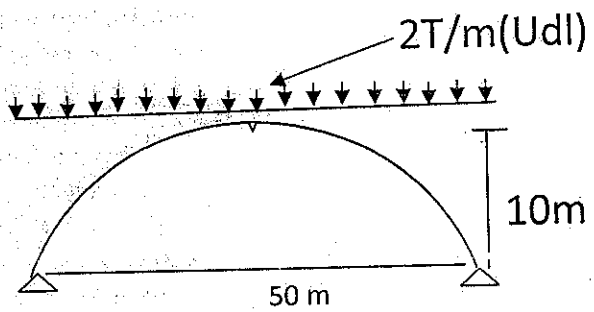


5. CO5 : i) Define unsymmetrical bending. 5+5+10=20
ii) What are the reasons for unsymmetrical bending.
iii) A beam of T Section(Flange- 60mm X 10 mm, web- 100mm X5 mm) is 3 metre long and simply supported at the ends. It carries a load of 3KN inclined at an angle of 20 degree to the vertical & passing through centroid of section.
If G= 200GN/M^2 ; calculate i) maximum tensile stress. ii) Maximum compressive stress & iii) maximum bending stress

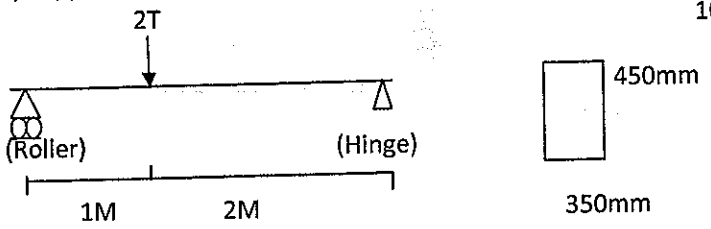
OR

i) Define the advantage of an arch with respect to a long span beam for uniformly distributed load.

ii) A three- hinged parabolic arch is loaded as shown below. Find the location and magnitude of maximum bending moment in the arch. Draw the B.M.D also. 5+15=20



6. CO6 : A simply supported beam is loaded as shown. Section of beam is 450mmX350mm 10



i) Find maximum and mimimum bending stresses

OR

ii) Find shear stress at a distance of 100mm above neutral axis