Ref. No. EX/CON/T/213/2018(S)

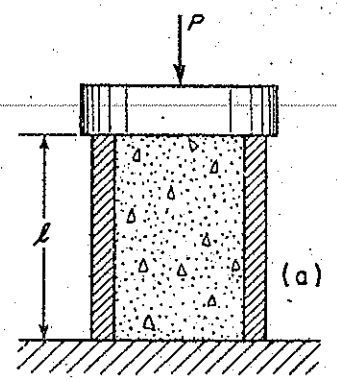
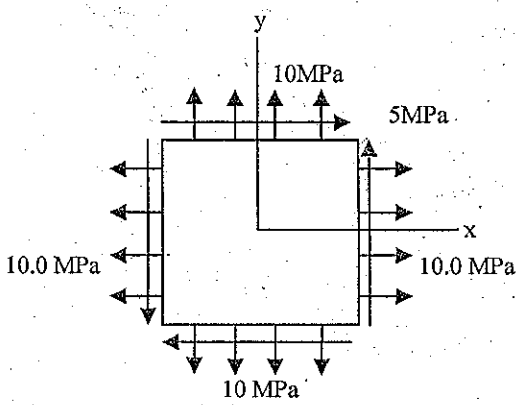
B. E. CONSTRUCTION ENGINEERING 3RD YR 1ST. SEMESTER
SUPPLYMENTARY EXAM.-2018

SUBJECT Strength of Material

Time : Three hours **Full Marks : 100**

50 marks for each part

Use Separate Answer scripts for each Part

No of Questions	Part I / ~~Part II~~	Marks
	Answer any Four Questions	
Q1.	A hollow steel cylinder of length = 30.00cm, inside diameter d = 15.00cm and uniform wall thickness t = 3.00mm is filled with concrete and compressed between rigid parallel plates by a load P = 500 KN as shown in Fig A. Calculate the compressive stress in each material and the total shortening of the cylinder if $E_s = 2 \times 10^5$ N/mm² for the steel and $F_c = 2 \times 10^4$ N/mm² for the concrete. Assume that both the materials obey Hooke's law.	12.5
	 **Fig.A**	
Q2.	A plane element is subjected to stresses as shown in Fig. B. Draw Mohr's Circle and determine a) The principal stress and their directions. b) The maximum shear stress and the direction of the planes on which they occur.  **Fig. B**	12.5

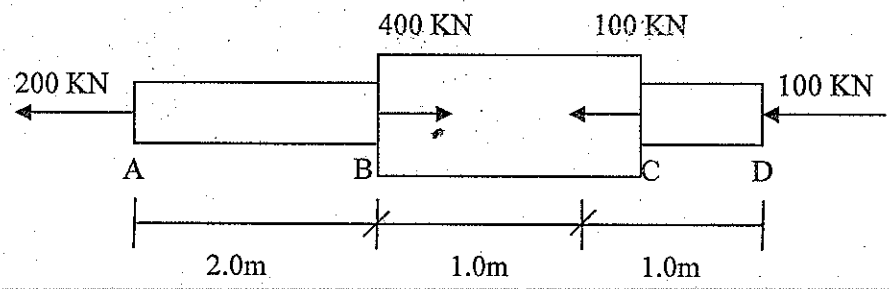
Ref. No. EX/CON/T/213/2018(S)

B. E. CONSTRUCTION ENGINEERING 3RD YR 1ST. SEMESTER SUPPLYMENTARY EXAM.-2018

SUBJECT Strength of Material

Time : Three hours **Full Marks : 100**

50 marks for each part

No of Questions	Part I / ~~Part II~~	Marks
Q3.	An elastic steel bar of variable cross section is subjected to axial loads as shown in the Fig.- C. The cross sectional areas of segments AB, BC and CD are 1000 mm², 2000 mm² and 1000mm² respectively. Evaluate the elongation of the bar. E = 20 x 10^5 MPa.  **Fig. C**	12.5
Q4.	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.	12.5
Q5.	A solid steel bar having circular cross section of diameter 40mm and length 1.5m is subjected to a torque of 375 N-M. What is the maximum shear stress in the bar? What is the angle of twist between the ends? If the allowable shear stress is 50 MPa and allowable angle of twist is 2.5°, what is the maximum permissible torque? Assume G = 1.0 x 10^5 MPa.	12.5
Q6.a.	State whether the following statements are True or False i) Shear stress due to torsion applied to a circular bar is maximum at the centre of cross section of the bar. ii) Structural steel is a ductile material where as cast iron is a brittle material. iii) The more ductile material is capable of absorbing less energy than the less ductile material iv) In case of biaxial stress, the maximum shear stress is $\tau max = \frac{1}{2}(\sigma x - \sigma y)$, where σx and σy are mutually perpendicular normal stress is in x and y direction. v) In case of biaxial stress, the sum of complimentary normal stress is constant and equal to $\sigma x + \sigma y$.	5

Ref. No. EX/CON/T/213/2018(S)

B. E. CONSTRUCTION ENGINEERING 3RD YR 1ST. SEMESTER SUPPLYMENTARY EXAM.-2018

SUBJECT Strength of Material

Time : Three hours | **Full Marks : 100**

50 marks for each part

No of Questions	Part I / ~~Part II~~	Marks
Q6.b.	Derive the relation between Young's modulus E, Poisson's ratio μ and shear modulus G.	7.5
Q7.	Derive from the first principles the following expressions i) $\tau = Gr\theta$ ii) $\Phi = \frac{TL}{GJ}$ Where τ = shear stress G = shear modulus θ = angle of twist per unit length of the shaft r = radius of the cross section of the shaft Φ = total angle of twist T = applied torque L = length of the shaft J = polar moment of inertia Draw neat sketches and clearly state the assumption if any	12.5

Ref: Ex/CON/T/213/2018(S).

B.E CONSTRUCTION ENGG SECOND YEAR 1ST SEMESTER SUPPLEMENTARY EXAM -2018

Subject: STRENGTH OF MATERIALS Part- II Full Marks:50

Answer any two

12.5×2=25

1.a) Define types of support normally assumed for different structures. Define determinate and Indeterminate structures. Draw 2 sketches for each type.

b) Deduce the relationships among force ,shear force and bending moment.

12.5×2=25

2. From the relation : M/I=E/R=q/y where the notions have their usual meanings ;

i) Resisting Moment is directly proportional to 2nd Moment of Inertia at a point for a constant applied moment.

ii) Stress is proportional to distance from neutral axis.

iii) Resisting moment increases with increase of depth.

(Do not deduce the relation)

12.5×2=25

3. Answer all

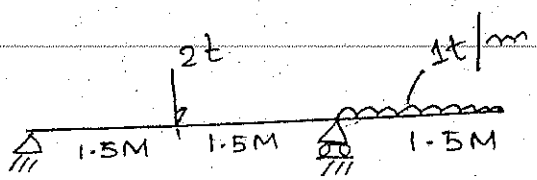


Fig-1

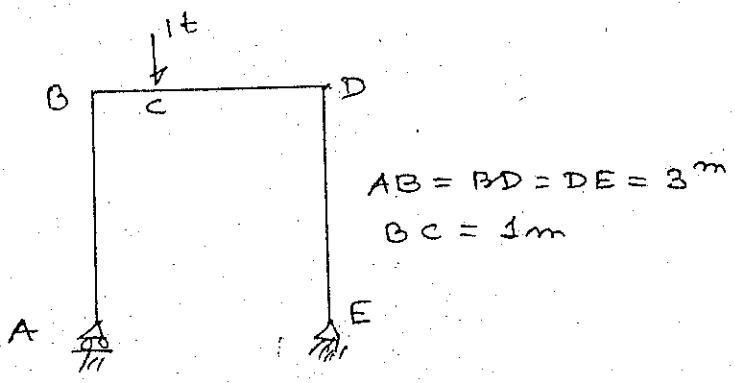


Fig-2