

# END TERM EXAMINATION

THIRD SEMESTER [B.TECH.] DECEMBER 2015

Paper Code: ETCE-203

Subject: Strength of Material

Time: 3 Hours

Maximum Marks: 75

Note: Attempt any five questions including Q. no. 1 which is compulsory.  
Scientific calculator is allowed.

Q1 Attempt all of the following: (2.5x10=25)

- (a) The young's modulus of elasticity of a material is twice its modulus of rigidity. Find the Poisson's ratio of the material.
- (b) What do you mean by principal plane and principal stress?
- (c) A prismatic bar of volume  $V$  is subjected to a tensile force in longitudinal direction. If Poisson's ratio of the material is  $\mu$  and longitudinal strain is  $\epsilon$ , find the final volume of the bar.
- (d) What is pure bending? Give two examples of pure bending.
- (e) Find the ratio of width to depth of a strongest beam that can be cut out of a cylindrical log of wood.
- (f) A beam of square section with side 100m is placed with one diagonal horizontal. Find the maximum shear stress if shear force acting on the section is 12kN.
- (g) What is middle third rule? For no tension criteria find the expression for core of a solid circular section.
- (h) Explain Castiglano's first theorem.
- (i) A solid circular shaft of steel is 50mm in diameter. Find the power transmitted at 120 r.p.m if the permissible shear stress is 60 MPa.
- (j) What are the limitations of Euler's formula

Q2 Two vertical rods, one of steel and other of copper, are each rigidly fastened at the upper end 600 mm apart. Each rod is 3.0 m long and  $100\text{mm}^2$  in cross-sectional area. A horizontal cross bar connects the lower end of rods and on it is placed a load of 100 KN so that the cross bar remains horizontal. Find the position of load on cross bar and estimate the stress in each rod.  $E_{\text{steel}} = 210 \text{ GPa}$  and  $E_{\text{copper}} = 120 \text{ GPa}$  (12.5)

Q3 A simply supported beam of span  $L$  is loaded with a triangular load with intensity zero at one end and  $w$  per unit length at the other end. Draw S.F.D. and B.M.D indicating the principal values. (12.5)

Q4 A simply supported beam of span  $L$  is loaded with u.d.l. of intensity  $w$  over the whole span. Using conjugate beam method, calculate slopes at the ends and central deflection. (12.5)

Q5 Compare the ratio of strength of a solid steel column to that of a hollow of the same cross-sectional area. The internal diameter of hollow column is 75% of external diameter. The columns have the same length and are hinged at the ends. (12.5)

Q6 Compare the flexural strength of the following three beams of equal weight: (12.5)  
(a) I-section 30cm x 15cm having 2cm thick flange and 1.25 cm thick web.  
(b) Rectangular section having depth equal to twice the depth.  
(c) Solid circular section.

Q7 A square chimney 25m high, having an opening of  $1\text{m} \times 1\text{m}$  is subjected to a horizontal wind pressure of  $1.50 \text{ KN/m}^2$ . Find the necessary thickness at the base of chimney which is of brickwork. Unit weight of brick masonry is  $19 \text{ KN/m}^3$  and the maximum permissible stress on brick masonry is limited to  $0.80 \text{ MPa}$ . (12.5)

Q8 (a) Explain the concept of Mohr's Circle for determining stresses and strain. (6.5)  
(b) Explain why do we need a failure theory. Explain in detail the concept of any one Failure theory. (6)

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