(Please write your Exam Roll No.) Exam Roll No. 10818003416

END TERM EXAMINATION

THIRD SEMESTER [B.TECH] NOVEMBER – DECEMBER 2017

Paper Code: ETCE-203 Subject: Strength of Materials

Time: 3 Hours Maximum Marks: 75

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

(10x2.5=25)

Q1 Attempt all parts:-

(a) Define complimentary shear stress.
(b) What do we mean by neutral axis?
(c) Define point of contraflexure.
(d) What do we mean by longitudinal strain, lateral strain and Poisson's ratio?
(e) Differentiate between a fixed support and simple support with the help of free body diagram.
(f) Define slenderness ratio in case of columns.
(g) What do we mean by principle planes and principle stresses?
(h) Write the assumptions of theory of pure torsion.
(i) Differentiate between long and short columns.
(j) State Castigliano's Theorem.

Q2 At a point within a body subjected to two mutually perpendicular direction the stresses are 80MPa tensile and 40 MPa tensile. Each of the above stress is accompanied by a shear stress of 60 MPa. 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 with the help of Mohr circle. Also find the principle stresses and location of principle planes. **(12.5)**

Q3 A beam 8.5 m long rests on supports 5 m apart. The right hand end overhanging by 2m and left end by 1.5m. the beam carries a uniformly distributed load 50kN per meter run between the supports only. The beam also carries a point load of 60 kN at the extreme right hand end and a point load of 40 kN at the left end. Construct the shear force and bending moment diagrams stating there on all the important values of shear force and bending moment. State the position of point of inflexion on the beam. **(12.5)**

Q4 The cross-section of the cast iron beam is shown in the Fig.1. This beam is simply supported at the ends and carries a uniformly distributed load of 20 kN/m. If the span of the beam is 3 m, determine the maximum tensile and compressive stresses in the beam. **(12.5)**

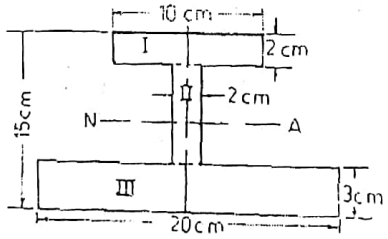

Figure 1

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Q5 A beam of length 4m is simply supported at its ends. It carries a uniformly distributed load of 20 kN/m as shown in Figure 2. Determine the deflection of the beam at its mid-point and also the position of maximum deflection and maximum deflection. Take E=200 GPa and I=9600 cm⁴. **(12.5)**

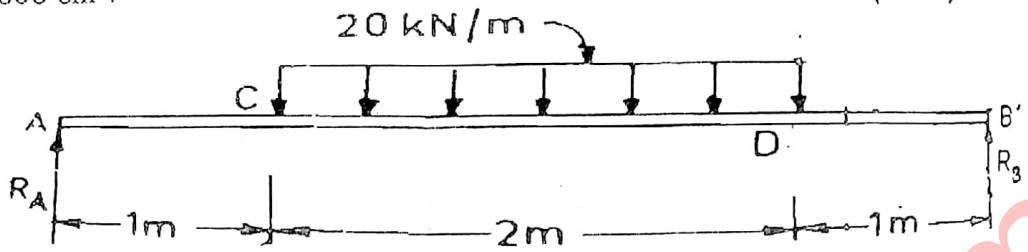

Figure 2

Q6 A masonry dam, 8m high, 1.5 m wide at top and 4m wide at the base has its water face vertical and retains water to a depth of 6m. Find the maximum and minimum stress intensities at the base. The density of water is 1000 kg/m³ and that of the masonry is 2240 kg/m³. **(12.5)**

Q7 A solid shaft is to transmit 300 kW at 100 r.p.m. If the shear stress is not to exceed 80 MPa, find the diameter of the shaft. What percent saving in weight would be obtained if this shaft is to be replaced by a hollow one whose internal diameter equals 0.6 of the external diameter? The length, material and maximum shear stress being the same. **(12.5)**

Q8 (a) Derive the expression for Euler's for a column fixed at its both ends. **(6)**

(b) Compare the crippling loads given by Rankine's and Euler's formulae for tubular strut 225 mm long having outer and inner diameters 37.5 mm and 32.5 mm respectively loaded through pin joints at both ends. Take yield stress as 315 MPa; $\alpha = \frac{1}{7500}$; and E=200 GPa. If the elastic limit for the material is taken as 200 MPa, below what length of the strut does the Euler formula ceases to apply. **(6.5)**

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