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Total No. of Questions : 5] [Total No. of Printed Pages : 4

EGS-132

B.E. 3rd Sem. (CGPA) Mech. Engg. (Zero Sem.)

Examination- 2019

MECHANICS OF MATERIAL

Paper– M- 302

Time : 3 hours] [Maximum marks : 60

Note : ***Attempt all questions from each unit. All questions carry equal marks. Assume suitable data wherever needed.***

Unit-I

1. (a) Define Bulk Modulus and Volumetric Strain. 5

(b) A steel bar 300 mm long, 50 mm wide and 40 mm thick is subjected to a pull of 300 KN in the direction of its length. Determine the change in volume. Take $E = 200$ GPA and $\mu = 0.25$. 7

or

(c) At a point in a stressed body the principal stress are 100 MPa (Tensile) and 60 MPa (Comp.). Determine the normal stress and shear stress on a plane inclined at 50° (degree) to the axis of major principal stress. Also calculate maximum shear stress at the point. 7

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Unit-II

2. (a) What are the assumptions made in theory of simple bending? 4

(b) A beam of symmetrical section; 400 mm deep & $I = 12 \times 10^7$ mm^4 carries U.D.L. of 10 KN/m. Find maximum span of beam, if the maximum stress is not to exceed 160 MPa. With the same span. Calculate maximum central point load if maximum stress is not exceeding as given above. 8

or

(c) A beam consists of a symmetrical rolled steel joist. The beam is a simply supported at its ends and carries a point load at the centre of the span. If the maximum stress due to bending is 150 MPa. Find the ratio of the depth of the beam section to span in order that the central deflection is limited to 0.2% of the span of beam. Take E = 200 MPa. 8

Unit-III

3. (a) Explain Macaulay's method. 5

(b) A cantilever 120 mm wide and 200 mm deep is 2.5 m long. What is the uniformly distributed load which the beam carry in order to produce a deflection of 5 mm at the free end. Take E = 200 GN/m^2. 7

or

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(c) Draw a shear force and bending moment diagram for a simply supported beam of length 9m and a carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate maximum B.M. on the section. 7

Unit-IV

4. (a) Define Column and Strut. 4

(b) A shaft has to transmit 140 H.P. at 160 rpm. If the shear stress is not to exceed 60 MPa and the twist in a length of 300 cm must not exceed 1°(degree), find the suitable diameter of the shaft. Take $G = 8\times10^4$ MPa. 8

or

(c) A round steel rod of dia. 15 mm and length 2 m is subjected to a gradually increasing axial compressive load. Using Euler's formula, calculate the buckling load. Find also the maximum lateral deflection corresponding to the buckling condition both ends of the rod may be taken as hinged. Take E=210 GPA and yield stress of steel = 250 MPa. 8

Unit-V

5. (a) Show that in thin cylinder shells subjected to internal fluid pressure, the circumferential stress is twice the longitudinal stress. 5

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(b) Calculate: (i) the change in diameter (ii) change in length and (iii) change in volume of a thin cylindrical shell 100 cm diameter, 1 cm thick and 5 m long when subjected to internal pressure of 3 MPa. Take the value of $E = 200$ GPA and Poisson's ratio as 0.3. 7

or

(c) Determine the maximum and minimum hoop stress across the section of the pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution across the section. 7

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