F 3158 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Automobile Engineering/Mechanical Engineering/Production Engineering/Polymer Engineering

AU 010 306/ME 010 306/PE 010 306/PO 010 306—STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING [AU, ME, PE, PO]

(New Scheme—2010 admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Distinguish between axial strain and shear strain.
2. Sketch an overhanging beam and mention its applications.
3. Define "economic section beams of uniform strength" ?
4. What are "compound pipes" ?
5. Differentiate between flexural and torsional loads.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Briefly discuss the procedure for uniaxial tension test.
7. Differentiate between concentrated and uniformly distributed loading, with a neat sketch.
8. Derive an expression for deflection for cantilever with a U.D.L. over whole of its span.
9. Derive the torsional formula for circular shafts.
10. Does a long column undergo yielding or fracture when buckling load is reached ?

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (a) A rigid beam is suspended from three rods having 300 mm spacing between the adjacent rods. The outer rods are 1 m long but the middle rod is made 0.5 mm shorter than the outer two rods and assembled with initial stress. Determine the stresses in the rods. The cross sectional area of each rod is $2cm^2$, and E= 200 GPa.

Or

(b) Derive an expression for the relationship among the elastic constants E, G, K and μ.

12. (a) A beam 9m long is simply supported at left end and at 6m from left end. The beam carries a concentrated load of 1.5 kN at its right end in addition to a total uniformly distributed load of 8 kN on the left 3 m of the beam. Draw shear force and bending moment diagrams giving maximum shear force and bending moment where does the point of contra flexure occur ?

Or

(b) A simply supported beam, with equal overhangs on the two ends, carries a U.D.L. of 500 N/m over whole of its length. If the supported length is 10m, find the overhangs such that (i) the bending moment is zero at the centre and (ii) the maximum negative and maximum positive bending moments are equal. Draw bending moment and shear force diagrams for cases (i) and (ii).

13. (a) A beam 300 cm long simply supported at ends carries a U.D.L over whole of its span. The beam is supported with its cross-sectional width inclined at 70° to the vertical. The cross-section is rectangular 7.5 cm deep × 5 cm wide. If the direct stress in the section is to be $80\ MN/m^2$, find the safe U.D.L. what is the vertical direction of the mid-span of the beam ?

Or

(b) A beam $4l$ long is simply supported at distance l and $3l$. The beam carries concentrated loads P1, P2 at distances 0, 2l and 4l respectively from one end. Find the ratio P_2/P_1 for equal deflection under the loads.

14. (a) Two shafts A and B are made of same material. Each shaft transmits the same power, shaft A running at 200 r.p.m. while the shaft B running at 20,000 r.p.m. Find the ratio of diameters of the two shafts, if the same maximum shear stress is developed in each shaft.

Or

(b) Plot a curve showing the percentage increase in maximum circumferential stress over average circumferential stress for ratios of thickness to the inside radius of a thick walled cylinder varying from 0 to 3. The cylinder has only internal pressure.

15. (a) The maximum normal stress and the maximum shear stress for a shaft of 150 mm diameter, under combined bending and torsion, were found to be 120 MN/m^2 and 80 MN/m^2 respectively. Find the bending moment and torque to which shaft is subjected. If the maximum shear stress be limited to 100 MN/m2, find by how much the torque can be increased if bending moment is kept constant.

Or

(b) For a steel column having area of cross-section of 100 cm^2 with least radius of gyration of 6.3 cm, find the safe load if the length of column is (i) 2.52 m (ii) 6.3 m and (iii) 11.34 m. Use the following set of formulae.

$$P/A = 87.5 \times 10^6 \, N/m^2 \text{ for } 0 \le l/k \le 50 \quad P/A = 105 \times 10^6 \left(1 - \frac{l}{300k}\right) N/m^2, \text{ for } 50 \le l/k \le 150.$$

$$P/A = \frac{6.4 \in}{(l/k)^2} \text{ for } l/k > 150.$$

In each of the above formula, P is the safe load. Take $\in$ = 200 GN/m^2.

(5 × 12 = 60 marks)