Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (Mechanical Engineering) (Sem.–4)

STRENGTH OF MATERIALS-II

Subject Code : BTME-403-18

M.Code : 77548

Date of Examination : 07-07-22

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) Define strain energy.

b) Discuss Castigliano's first theorem.

c) Enlist various applications of spring working under tensile load, compressive load and bending load.

d) State assumptions made in Lame's theory.

e) Enlist applications of flat spring.

f) What do you understand by rotational disc of uniform strength?

g) Derive expression for position of neutral axis for the section of bar having initial curvature and under the action of external bending moment.

h) Show the graphical representation of maximum shear stress theory.

i) Derive expression for longitudinal stress developed in the material of a thin cylindrical shell when subjected to internal fluid pressure.

j) With a help of a plot, show the trend of variation of shear stress along the section of a T- shaped beam.

SECTION-B

2. Derive expression for strain energy in three dimensional stress system.

3. Calculate the thickness of the metal necessary for a thick steel cylindrical shell of internal diameter 0.15 m to withstand an internal pressure of 50 MPa; the maximum permissible tensile stress is not to exceed 150 MPa.

4. A mild steel shaft of 120 mm diameter is to sustain a maximum torque of 20 kNm and maximum bending moment of 12 kNm at a point in the material. Determine the factor of safety according to maximum shear stress theory when the elastic limit in simple tension is 220 MPa.

5. A close-coiled helical spring made of 6 mm diameter steel wire and have 10 turns is subjected to an axial couple M. The mean coil diameter is 42 mm. If the maximum bending stress in spring wire is not to exceed 240 MN/m^2, find the magnitude of M and one end of Sprittg is turned relative to the other end. E = 200 GPa.

6. Show graphically the variation of shear stress in rectangular beam cross-section. Also prove that the maximum value of shear stress is 1.5 times the mean shear stress for the rectangular section.

SECTION-C

7. The gauge pressure in a boiler of 1.5 m diameter and 12.5 mm thickness is 2 MPa. Find the longitudinal and circumferential stresses in the boiler. Also find the longitudinal, circumferential and volumetric strains developed in the material. Take E = 200 GPa and Poisson's ratio = 0.3.

8. Find the intensities of principal stresses in a flat steel disc of uniform thickness when rotating at 2400 *rpm.* The diameter of the disc is 1 m and has a central hole of diameter 0.2 m. Poisson's ratio = 0.3 and density of steel = 7800 Kg/m^3.

9. A steel bar 38 mm in diameter is bent into a curve of mean radius 32 mm. If a bending moment of 4.6 Nm tending to increase the curvature acts on the bar, find the intensities of maximum tensile and compression stresses. Also draw the variation of normal stress over the cross-section.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.