

[Total No. of Questions - 9] [Total No. of Printed Pages - 3]

Dec-22-0153

ME-402 (Strength of Materials-II)
(ME, AE)

B.Tech-4th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

- Note:** (i) This question paper carries five sections. Attempt five questions in all, select one question from each sections A, B, C & D. Section E is compulsory.
(ii) Use of non-programmable calculator is allowed.
(iii) Assume missing data suitably if any and specify the same.

SECTION-A

1. A cylindrical shell 2 m long and 90 cm internal diameter and 12 mm metal thickness is subjected to an internal pressure of 1.6 N/mm^2 . Determine (a) maximum intensity of shear stress (b) changes in the dimensions of the shell.
Take $E=2 \times 10^5 \text{ N/mm}^2$ and $1/m = 0.3$. (10)
2. A thick spherical shell of 200 mm internal diameter is subjected to an internal fluid pressure of 7 N/mm^2 . If the permissible tensile stress in the shell material is 8 N/mm^2 , find the thickness of the shell. (10)

SECTION-B

3. The minimum thickness of a turbine rotor is 9 mm at a radius of 300 mm. If the rotor is to be designed for a uniform stress of 200 MN/m^2 , find the thickness of the rotor at a radius of 25 mm when it is running at 9000 rpm. Take $\rho = 8000 \text{ kg/m}^3$. (10)

4. Find an expression for the circumferential and radial stresses developed in a rotating solid disc. (10)

SECTION-C

5. Derive an expression for the Euler's crippling load for a long column with following end conditions:
(i) Both ends are hinged
(ii) Both ends are fixed (10)
6. A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100 N. Calculate (i) the maximum shear stress induced (ii) the deflection (iii) stiffness of the spring. Take modulus of rigidity $C = 8.16 \times 10^4 \text{ N/mm}^2$. (10)

SECTION-D

7. A crane hook having a trapezoidal horizontal cross-section is 50 mm wide inside and 30 mm wide outside. Thickness of the section is 60 mm. The crane hook carries a vertical load of 20 kN whose line of action is 50 mm from the inside edge of the section. The centre of curvature is 60 mm from the inside edge. Determine the maximum tensile and compressive stresses in the section. (10)
8. A 4 m long simply supported beam of 80 mm width and 100 mm depth carries a load of 10 kN at the midspan. The load is inclined at 30° to the vertical longitudinal plane and the line of action of the load passes through the centroid of the rectangular section of the beam. Determine the stresses at all the corners of the section. (10)

[P.T.O.]

SECTION-E

9. (i) What assumptions are taken in the analysis of thin cylinders?
- (ii) Differentiate between a thin cylinder and a thick cylinder.
- (iii) What do you understand by wire-wound cylinders?
- (iv) What do you mean by a disc of uniform strength?
- (v) What is a strut? How does it differ from a column?
- (vi) Define slenderness ratio of a column? What is its importance?
- (vii) State the limitations of Euler's formula.
- (viii) What are leaf springs?
- (ix) What are the assumptions made in the derivation of stresses in a curved bar which is subjected to bending moments?
- (x) What do you mean by unsymmetrical bending?

(10×2=20)