

16036(J)

B. Tech 4th Semester Examination

Strength of Materials-II (NS)

ME-223

Time : 3 Hours

Max. Marks : 100

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 : Attempt five questions in all selecting one question each from section A, B, C, D of the paper and all sub-parts of question no. 9 of section-E. Use of Non programmable calculator is allowed.

SECTION - A

1. (a) Derive an expression for circumferential stress and longitudinal stress of thin cylindrical shell. (10)
- (b) A cylindrical shell is 3 m long, 1.5 m internal diameter and 20 mm thick. Calculate the intensity of maximum shear stress induced and also change in dimension of the shell if it is subjected to an internal pressure of 2N/m^2 . Take $E = 0.2 \times 10^6 \text{ N/mm}^2$ and $\nu = 0.3$. (10)
2. (a) Derive an expression for stresses in thick spherical shells subjected to an internal fluid pressure. (10)
- (b) A cast iron pipe of 400 mm internal diameter and 100 mm thickness carries water under a pressure of 8N/mm^2 . Determine the maximum and minimum intensities of hoop stress across the section, also sketch the radial pressure distribution and hoop stress distribution across the section. (10)

[P.T.O.]

3. (a) Derive an expression for circumferential and radial stresses in a solid cylinder. (10)
- (b) The minimum thickness of turbine rotor is 9 mm at radius of 300 mm. 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. (a) What do you mean by disc of uniform strength? Find an expression for the thickness of a disc of uniform strength. (10)
- (b) A flat steel disc 76 cm outside diameter with 16 cm diameter hole is shrink fitted on to a solid steel shaft. If the shrinkage allowance is 0.008 cm on radius calculate (i) the speed at which the shrink fit will loosen (ii) The maximum hoop stress in the disc at the speed calculated in part (i), (iii) max hoop stress in the disc at stand still. Assume $\rho = 7600 \text{ Kg/m}^3$ $E = 206 \text{ GN/m}^2$, $\nu = 0.3$ (10)

SECTION - C

5. (a) What is link radius? Obtain the value of link radius for a Trapezoidal section. (10)
- (b) A close circular link made up of 20 mm diameter steel bar is subjected to a pull of 10 KN, whose line of action passes through the center of the ring. Find the maximum value of tensile and compressive stresses in the ring, if the mean diameter of the ring is 160 mm. (10)

6. (a) An open coiled helical spring is subjected to an axial load of 50 KN, Determine the deflection of the spring and maximum shear stress in the spring wire. The spring particulars are : No of coils = 4, mean radius of coil 30 mm, Diameter of spring wire 5 mm, Modulus of rigidity 80,000MPa, Angle of helix 10° , Young's modulus $E=2 \times 10^5$ N/mm². (10)
- (b) A flat spiral spring is made up of 5 mm wide and 2 mm thick wire and is 100 cm long. At the point of maximum bending, Maximum applied stress is 1000N/mm². Calculate the torque, the energy stored and the number of turns to wind up the spring. Take $E=2 \times 10^5$ N/mm². (10)

SECTION - D

7. (a) State and prove Clapeyron's theorem of three moments. (10)
- (b) Find the position of shear centre of a thin arc of a circle which subtends an angle of 90° at the centre and has a mean radius of 10 cm. (10)
8. A continuous beam ABCD of length 15 m rests on four supports covering 3 equal spans and carries a uniformly distributed load of 1.5N /m length. Calculate the moments and reactions at the supports. Draw the SFD and BMD also. (20)

SECTION - E

9. (a) What do you mean by thick shell?
- (b) What are various types of springs? Distinguish clearly between bending spring and torsion spring.

[P.T.O.]

- (c) What is laminated spring? Where it is used?
- (d) What is difference between thin cylindrical shell and a thick cylindrical shell?
- (e) Give the assumptions for determining the stresses in the bending of curved bars?
- (f) Find resultant stress in case of circular ring when subjected to tensile load
- (g) Write resultant stress in a curved bar subjected to direct stress and bending stress.
- (h) What is strength of a section?
- (i) Find the stiffness of each resulting spring if a helical compression spring is cut in to two equal halves.
- (j) What is torsional rigidity? (2×10=20)