[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

15120

B. Tech 4th Semester Examination

Strength of Materials-II (OS)

ME-4003

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 : (i) Attempt five questions in all selecting one question from each of the sections A, B, C and D. Section E is compulsory.

(ii) Assume missing data if any.

(iii) Use of non-programmable calculator is allowed.

SECTION - A

1. (a) What is slope of neutral axis? Briefly enumerate its importance.

   (b) A rectangular-section beam 80 mm x 50 mm is arranged as a cantilever 1.3 m long and loaded at its free end with a load of 5 kN inclined at an angle of 30° with the negative direction of the vertical axis or in i.e. 60° with negative direction of horizontal axis. The load acts at the CG of the beam cross-section. Determine the position and magnitude of the greatest tensile stress in the section. What will be the vertical deflection at the end? Take $E = 210\ GN/m^2$. (5+15=20)

2. (a) Deduce the expression for the general form of three moments and discuss all cases related to this.

[P.T.O.]

   (b) A continuous beam, 12 m long supported over spans AB=BC=CD= 4 m, carries a uniformly distributed load of 3 kN/m run over span AB, a concentrated load of 4 kN at a distance of 1 m from point B on support BC and a load of 3 kN at the centre of the span CD, find: Support moments and support reactions, also draw the BM Diagram. (5+15=20)

SECTION - B

3. (a) A thin cylindrical shell gets deformed by the circumferential and longitudinal stresses deduce appropriate relation for changes in its dimensions and change in volume.

   (b) The ends of a thin cylinder 200 mm diameter and 3 mm wall thickness are closed by rigid plates. The cylinder is then filled by liquid. The pressure of the liquid rises by 75 kPa when an axial compressive force of 35 kN is applied to the cylinder. Find the bulk modulus of the liquid if E=210 GPa and Poisson ratio = 0.25. (5+15=20)

4. A cylinder of 15 cm internal diameter and 20 cm external diameter is subjected to liquid pressure from inside. There is also a compressive load of 210 kN acting at the ends of the cylinder. Find the greatest pressure of the liquid so that the maximum stresses in the material may not exceed 45 MPa. (20)

SECTION - C

5. A steel disc of uniform thickness rotating at 2500 rpm about its axis has a diameter of 450 mm. If the density of the material is 7700 kg/m^3 and Poisson's ratio is 0.33, determine the radial and circumferential stresses. Draw the variations of the stresses along the radius of the disc. (20)

6. A hollow cylinder of 25 cm external diameter and 15 cm internal diameter is rotating at 2000 rpm. Calculate maximum stress in the cylinder and plot the variation of radial and hoop stresses in the cylinder. Take Poisson's ratio as 0.3 and density of the material as 7470 kg/m^3. (20)

SECTION - D

7. A central horizontal section of hook is a symmetrical trapezium 65 mm deep, the inner width is 60 mm and outer is 30 mm. Determine the extreme intensities of stress when the hook carries a load of 35 kN, the load passing through 40 mm from the inside edge of the section and the centre of curvature being in the load line. Plot the stress distribution across the section. (20)

8. (a) Deduce the relation for deflection in an open coiled helical spring subjected to axial load.

   (b) A close coiled helical spring is required to absorb 2.25 x 10^3 joules of energy. Determine the diameter of wire, mean diameter of the spring and the number of coils necessary if:

   (i) The maximum stress is not to exceed 400 MPa.

   (ii) The maximum compression of spring is limited to 250 mm.

   (iii) Mean diameter of spring is eight times the diameter of the spring wire. (5+15=20)

SECTION - E

9. (i) What are the assumptions made in bending of beams?

   (ii) What type of stresses act in case of spherical vessels? Write suitable relations.

(iii) What are thin cylindrical shells? How are these designed? Discuss briefly.

(iv) What is flexural axis? Is it different to neutral axis?

(v) How change in volume affects a thin spherical vessel?

(vi) What types of stresses are developed in thick cylinders? Write the assumptions involved for driving such equations.

(vii) What are the assumptions associated with continuous beams?

(viii) What is the function of spokes in disks?

(ix) What type of stresses are developed in a crane hook?

(x) What are the applications of springs? Discuss with examples. (2×10=20)