Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 1034228

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV / DEC 2024
Fourth Semester
Civil Engineering
U20CE402 – STRENGTH OF MATERIALS – II
(Regulation 2020)

Time: Three Hours | Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. What is middle third rule?

2. Write the assumptions made in Euler's theory of column.

3. How to get the slope and deflection of a real beam from the corresponding conjugate beam?

4. State the principle of the moment area method.

5. Write the expressions for the hoop stress and longitudinal stress of a thin cylinder.

6. When is a cylinder called thick cylinder?

7. Explain principal planes and principal stresses.

8. List out various theories of failure.

9. Define degree of indeterminacy.

10. What is statically redundant frame?

PART – B (5 x 16 = 80 Marks)

11. (a) A column with one end hinged and the other end fixed has a length of 5m and a hollow circular cross section of outer dia 100 mm and wall thickness 10 mm. If E = 1.6 x 10^5 N/mm^2 and crushing strength σ_c = 350 N/mm^2, examine the load that the column may carry with a factor of safety of 2.5 according to Euler theory and Rankine-Gordon theory. (16)

(OR)

(b) A short column of hollow cylindrical section has outer dia 300 mm and inner dia 200 mm and carries a load of 300 kN at a distance of 80 mm from the centre of the column.
(i) Examine the extreme stresses and construct the stress diagram.
(ii) Identify the maximum eccentricity so that no tension develops in the column? (16)

12. (a) A beam of uniform flexural rigidity with I = 1.8 x 10^9 mm^4 and E = 2x10^5 N/mm^2 has a simply supported span of 10 m and carries concentrated loads of 100 kN and 60 kN at 2 m and 5 m respectively from left end.
Examine the following using Macaulay's method.
(i) Deflection under the loads
(ii) the maximum reflection; and
(iii) Slope at the ends. (16)

(OR)

(b) For the stepped cantilever beam in which the flexural rigidities of the two halves are as indicated in figure, examine the slope and deflection at the free end B. (16)

13. (a) A cylindrical pressure vessel with flat ends is 2 m long, 1.2 m in diameter, the wall thickness being 15 mm. If it is subjected to an internal pressure of 1.5 MPa, examine the hoop and longitudinal stresses, change in length and diameter and change in volume. (16)

(OR)

(b) A pipe of internal diameter 600 mm has wall thickness 100 mm and is subjected to an internal pressure of 10 MN/m^2. Identify the hoop stress at the inner and outer radii and construct the hoop stress and radial distribution diagram across the thickness of the wall of the thick cylinder. (16)

14. (a) A thin-walled cylindrical shell has a diameter of 1.2 m and wall thickness 12 mm. If elastic limit for the shell material as determined from a uniaxial tensile test is 270 N/mm^2, determine the maximum allowable internal pressure on the basis of
(i) Principal stress theory
(ii) Shear stress theory and
(iii) Shear strain energy theory. Take factor of safety = 3. (16)

(OR)

(b) At a point in a material the normal and shear stresses on two perpendicular planes are σ_x = 60 N/mm^2, σ_y = - 20 N/mm^2, τ_{xy} = 20 N/mm^2. Determine the following.
(i) The principal stresses and orientation of principal planes,
(ii) The maximum shear stress the orientation of the plane of maximum shear stress and the normal stress on the plane of maximum shear stress,
(iii) The stresses on a plane that is inclined at 30° clockwise with the plane of x. (16)

15. (a) Determine all the member forces of the truss shown in figure using the method of section. (16)

(OR)

(b) Determine all the member forces of the truss shown in figure using the method of joint. (16)

----- xxx -----