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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; May/June - 2018

Analysis of Plates

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Assume missing data suitably.

UNIT - I

1 a. List the assumption made in Kirchhoff's plate theory. 4

b. Show that in a slightly bent plate, the direction of minimum slope and the direction of maximum slope are at right angles to each other. 8

c. Show that the sum of curvature in any two mutually perpendicular directions in a slightly bent plate is a constant. 8

2 a. Derive an expression for deflection in a simply supported circular plate of radius '*a*' subjected to concentrated load '*p*' at its centre. 8

b. Show that $\frac{M_\theta}{M_r}.\mu$ in case of a circular plate of radius '*a*' fixed along the edges and subjected to uniformly distributed load of intensity '*q*'. 12

UNIT - II

3. Derive the expression for deflection surface, bending moment, twisting moment and shear force for a simply supported rectangular plate with sinusoidal loading given by 20

$$q = q_0 \sin\frac{m\pi x}{a}.\sin\frac{n\pi y}{b}$$

4 a. Derive the fourth order differential equation for deflected surface of laterally loaded rectangular plate. 10

b. Determine the deflection at the centre of simply supported rectangular plate of dimension 4 m x 3 m with long side along *x*-axis and short side along *y*-axis, the thickness of the plate is 40 mm and is subjected to uniformly distributed load of 4.16 kN/m^2. 5

Given E = 2×10^5 N/mm^2 and μ = 0.25.

c. Determine the deflection at the centre of simply supported rectangular plate of dimension 4 m x 3 m, the thickness of the plate is 40 mm and is subjected to a wheel load at centre having a magnitude of 50 kN with contact area of dimension 0.12 m x 0.15 m with respect to *x* and *y* axis. 5

Given E = 2×10^5 N/mm^2 and μ = 0.25.

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UNIT - III

5. Using Navier's solutions obtain the expressions for Maximum deflection for an all round simply supported rectangular plate subjected to Hydrostatic load q_o per unit length. 20

6. Using Levy's solution, obtain the expression for bending of rectangular plate subjected to symmetric moments distributed along the edges $y = \pm b/2$. 20

UNIT - IV

7. Obtain the solution for uniformly loaded simply supported rectangular plates with large deflection. 20

8. Derive the approximate formula for uniformly loaded circular plate with large deflection. 20

UNIT - V

9. A fixed plate of size 4h x 4h is subjected to uniformly distributed load q_o over its entire surface. Taking grid size as h x h determine; 20

   i) Deflection at the centre of the plate

   ii) Moment at the centre of the plate, take $\mu = 0.3$

10. A simply supported plate of size 4h x 4h is subjected to uniformly distributed load q_o over its entire surface. Taking grid size as h x h determine; 20

    i) Deflection at the centre of the plate

    ii) Moment at the the centre of the plate, take $\mu = 0.3$

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