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

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, M. Tech. - Mechanical Engineering (MMDN)

Semester End Examination; Dec - 2016/Jan - 2017

### Theory of Plates and Shells

Time: 3 hrs

Max. Marks: 100

**Note:** i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.

ii) Assume missing data, if any.

#### UNIT - I

- |      |   |    |
|------|---|----|
| 1 a. | Derive the differential equation for cylindrical bending of plates.   | 8  |
| b.   | Obtain the governing differential equations for small deflections of laterally loaded plates.                                 | 12 |
| 2 a. | State the assumptions made in the analysis of thin plates with small deflection.  | 6  |
| b.   | Derive an expression for deflection in cylindrical bending of uniformly loaded rectangular plate with simply supported edges. | 14 |

#### UNIT - II

- |      |  |    |
|------|--|----|
| 3 a. | Show that the sum of curvatures in any two mutually perpendicular directions is constant for pure bending of plates.   | 10 |
| b.   | Develop the relationship between moment and curvature in pure bending of plates.   | 10 |
| 4 a. | A rectangular sheet metal of 5 mm thickness is bent into a circular cylinder having a radius 'r'. Calculate the diameter of the cylinder and moment developed in the metal, if the allowable stress not to exceed 96 MPa. Given $E = 70 \text{ GPa}$ and $\nu = 0.3$ . | 8  |
| b.   | A circular plate with clamped edge of radius 'a' carries a load of intensity 'q' uniformly distributed over the entire surface of the plate. Develop the expression for bending moments $M_r$ and $M_t$ .  | 12 |

#### UNIT - III

- |    |  |    |
|----|--|----|
| 5. | Obtain an expression for maximum deflection of simply supported rectangular plates using Levy's method.  | 20 |
| 6. | Obtain an expression for deflection of simply supported rectangular plate by using Navier's method. Find maximum deflection for uniformly distributed load $P_0$ . | 20 |

#### UNIT - IV

- |      |   |    |
|------|---|----|
| 7 a. | State the assumptions made in the analysis of thin shells. Explain briefly the classifications of shells. | 10 |
| b.   | Distinguish between plate and shells. Mention their advantages and disadvantages.                         | 10 |

8. Establish the equations required for a circular cylindrical shells loaded symmetrically with respect to its axis. Then deduce it to the long cylinder submitted to the action of bending moments  $M_0$  and shearing forces  $Q_0$  at the ends. Also find the maximum deflection. 20

**UNIT - V**

- 9 a. Obtain the expression for forces  $N_x$ ,  $N_{\theta x}$  and  $N_\theta$  for a cylindrical shell of general shape subjected to asymmetrical loading. 10
- b. Explain DKJ theory and write its eight order differential equation. 10
10. Write short notes on the following :
- i) Behaviour of folded plates
  - ii) Kirchhoff's shear 20
  - iii) Edge beam theory-cylindrical shells
  - iv) Conical shells and long cylindrical shells.

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