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T 3 Examination – May 2019

M. Tech. 2nd Semester (Structural Engineering) and B Tech. 8th Semester (Civil Engineering)

Course Code: 12M1WCE214
Course Name: Theory of Plates and Shells
Course Credit: 03

Max. Marks: 35

Max. Time: 120 Minutes

Note: All questions are compulsory. Carrying of mobile phone during examination will be treated as case of unfair means. Assume any missing data. Draw clear sketch whereas required.

Q.1 Draw graphical representation of internal and external forces for a plate element subjected in Cartesian coordinate system. Draw a schematic for middle surface of the plate. [2+1]

Q.2 Develop strain, stress, and displacement relations for a material exhibit elastic deformation using Two-Dimensional Hooke's Law [Draw section sketch before and after deformation, also draw angular distortion diagram]. [4]

Q.3 Write boundary conditions for simply supported edge, fixed edge, and free edge for curved boundaries. [3]

Q.4 Develop plate differential equation for a plate strip, infinitely long in one direction and bent into cylindrical deflection surface. Develop solution for plate strip deflection using single Fourier's series. Also develop the expressions for internal moments and transverse shear. [5]

Q.5 Generalize the Navier's solution for a rectangular plate clamped along all four edges by using characteristic function of freely vibrating uniform beam. [6]

Q.6 Develop governing differential equation for moderately thick rectangular plate subjected under lateral load (P_z) using Reissner Theory. Write general expressions for transverse shear, bending moments. Also, write boundary conditions for fixed and free edges. [2.5+2.5+1]

Q.7 Develop governing differential equation for moderately thick rectangular plate subjected under lateral load (P_z) using Mindlin Theory. Write general expressions for transverse shear, bending moments. [3+2]

Q.8 An elliptical plate has major and minor axis equal to 2a and 2b, along the X and Y axes respectively. The ellipse has clamped boundary conditions along the outer edge and subjected under a constant lateral load (P_z=P_o). Prove that the closed-form, exact solution is

$$w = \frac{P_o a^4 b^4}{8D\,[3(a^2+b^2)^2-(2ab)^2]\left(\frac{x^2}{a^2}+\frac{y^2}{b^2}-1\right)^2}$$ [3]