ANALYSIS AND DESIGN OF CONCRETE SHELLS AND FOLDED PLATES

Course Code: 15CE2213

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Course Outcomes: At the end of the course, the student will be able to:

CO1: Classify the shells and know the shell action.
CO2: Understand the bending theory of cylindrical shells.
CO3: Design and detail cylindrical shells.
CO4: Analyse and detail folded plates.
CO5: Analyse and design doubly curved shells.

UNIT – I (10-Lectures)

Shell classification and shell action:

Singly curved and doubly curved shells – shells of translation and rotation – ruled surfaces – synclastic and anti-clastic shells – stress-resultants in a plate element and a plate-shell element – equilibrium equations for membrane stress- resultants – application to a simply supported cylindrical shell – limitations of the membrane theory.

UNIT – II (10-Lectures)

Bending Theory of Cylindrical Shells:

Theory of circular cylindrical shells with combined action of membrane and bending stress-resultants – derivation of D-K-J equation – use of ASCE Manual No. 31 method for analysis and design of long shells and short shells without edge beams.

UNIT – III (10-Lectures)

Simplified design and detailing of Cylindrical Shells:

Simplified beam theory of simply supported long cylindrical shells with and without edge beams – design of end diaphragms – detailing of reinforcement in shells, edge beams and end diaphragms.

UNIT – IV (10-Lectures)

Folded Plates:

Structural behaviour of trough type folded plate roofs – slab-beam

analysis of folded plates – correction analysis for edge shears – stress distribution – correction analysis for deflection and rotation – reinforcement in folded plates.

UNIT – V (10-Lectures)

Doubly Curved Shells:

Membrane theory for doubly curved shells of revolution – stress-resultants in a spherical dome – membrane theory of doubly curved shells other than shells of revolution – approximation for shallow shells – stress-resultants in an umbrella type HP shell roof – example of design of a HP shell roof.

TEXT BOOKS

1. Design and Construction of Concrete Shell Roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan BholaNath Nagar, shahotra, Delhi.
2. ASCE Manual of Engineering practice No. 31, Design of cylindrical concrete shell roofs ASC, New York.
3. Design of Reinforced Concrete Shells and Folded plates by P.C. Varghese, PHI Learning Private Limited, New Delhi (2010).

REFERENCES

1. Theory and Design of Concrete Shells by B.K. Chatterjee, Chapmann& Hall, New York, 3rd Edition.
2. Analysis of Thin Concrete Shells by K. Chandrasekhara, Oxford and IBH, Kolkata, 1971.
3. Thin Shell Structures by Bandopadhyay J.N. New Age International Publishers, New Delhi, 1986.