ADVANCED REINFORCED CONCRETE STRUCTURES

(Professional Elective- III)

Course Code: 19CE1160 **L T P C**
3 0 0 3

Pre-requisites: Strength of Materials, Building Materials and Concrete Technology, Reinforced Concrete Structures.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Design different types of staircases
CO2: Design cantilever and counterfort retaining walls
CO3: Design combined and Pile foundation systems
CO4: Analyse and design the rectangular water tanks as per I.S code
CO5: Analyse and design flat slab and grid floors using IS code

UNIT-I **(10 Lectures)**

STAIRCASES:

Introduction, types - design of dog-legged staircase-design of open well staircase with quarter span landing- design of stairs with central stringer beam.

Learning outcomes:
1. Explain different types of staircases (L2)
2. Design a dog legged staircase (L3)
3. Design an open well staircase (L3)

UNIT-II **(10 Lectures)**

RETAINING WALLS:

CANTILEVER RETAINING WALLS:

Introduction – Types of retaining walls – Active and passive earth pressure – Design principles of cantilever retaining walls with horizontal backfill – With horizontal backfill and traffic load – With sloping backfill.

COUNTERFORT RETAINING WALLS:

Design principles of Counterfort retaining walls with horizontal backfill – With horizontal back fill and traffic load – With sloping backfill- Reinforcement detailing and bar bending schedule.

Learning outcomes:
1. Classify different types of retaining walls (L2)
2. Explain the design principles of cantilever and counterfort retaining wall (L2)
3. Draw the reinforcement detailing and prepare bar bending schedule (L3)

UNIT-III **(10 Lectures)**

COMBINED FOOTINGS, PILES AND PILE CAPS

Combined footings- rectangular type combined footings only; pile design-design of bored cast-in-situ and precast piles only; pile cap-design of 2 pile cap and 3 pile caps only

Learning outcomes:

1. Illustrate the design concepts of rectangular type combined footings (L3)
2. Explain the design concepts of pile foundation (L2)
3. Design a pile cap for 2 piles and 3 piles (L3)

UNIT-IV **(10 Lectures)**

RECTANGULAR WATER TANKS

Introduction-Impermeability requirements-Design requirements-IS: 3370(part I), (part II), and (part IV)-permissible stresses in concrete and steel- minimum reinforcement-method of analysis-Approximate method & IS code method-Design of rectangular water tanks resting on ground-design of underground rectangular tanks-Design of rectangular overhead tanks

Learning outcomes:

1. Explain the design requirements of water tanks (L2)
2. Design a rectangular water tank (L3)
3. Draw the reinforcement detailing and prepare the bar bending schedule (L3)

UNIT-V **(10 Lectures)**

CIRCULAR AND INTZ TYPE WATER TANKS

Introduction-Design requirements-IS 3370 provisions-joints in water tanks-Flexible and Rigid joints- Approximate method & IS code method-Design of circular water tanks resting on ground-design of circular overhead tanks with flat bottom slab-Design of Intz tank-Design of supporting structure

Learning outcomes:

1. Design a circular water tank (L3)
2. Design an Intz tank (L3)
3. Draw the reinforcement detailing and prepare the bar bending schedule (L3)

TEXT BOOKS:

1. Pillai S.V. and Menon D, "Reinforced Concrete Design", 2nd Edition, Tata McGraw Hill, 2006.
2. Bhavikatti S.S., "Advance R.C.C Design (R.C.C Volume II)", 3rd Edition, New Age International Publishers, 2016.
3. Varghese P.C., "Limit State Design of Reinforced Concrete Structures", 3rd Edition Prentice hall of India, New Delhi, 2005.

REFERENCES:

1. Varghese P.C., "Advanced Reinforced Concrete Structures", 4th Edition, Prentice hall ofIndia, 2005.
2. Krishna Raju N, "Advanced Reinforced Concrete Design", 4th Edition, University Press,2007.
3. H.J. Shah, "Reinforced concrete", 11th Edition, Volume 1, Charotor Publishing House Pvt. Ltd., Anand, 2016.
4. Punmia B.C., Ashok Kumar Jain &Arun Kumar Jain, "Reinforced concrete structures", Volume – I, 5th Edition, Laxmi publications Pvt. Ltd., New Delhi, 2008.

IS codes.

1. IS 456: 2000 (Reaffirmed 2005): Indian Standard Plain and Reinforced Concrete – Code of Practice (or latest).
2. IS 3370: 1967 (Reaffirmed 2008): Code of Practice for Concrete structures for storage of liquids.
Part I - General requirements.
Part II - Reinforced Concrete Structures
Part IV - Design Tables
3. Special Publication SP-16, Design Aids for Reinforced Concrete of IS 456: 1978.