ADVANCED DESIGN OF CONCRETE STRUCTURES

Course Code: 13CE 2201 **L P C**
4 0 3

Course Outcomes:
At the end of the course the student will be able to
CO1 : Estimate the crack width and deflection with regard to serviceability.
CO2 : Analyse and design a grid floor system
CO3 : Analyse and design a flat slab system
CO4 : Discuss fire and seismic resistance of concrete structures
CO5 : **A**nalyse and design bunkers, silos and chimneys

UNIT – I
DEFLECTION AND CRACK WIDTH ESTIMATION:

Deflection of Reinforced Concrete Beams and Slabs: Introduction, Short-term deflection of beams and slabs, Deflection due to imposed loads, Short-term deflection of beams due to applied loads, Deflection of slabs by IS 456.

Estimation of Crack width in Reinforced Concrete Members: Introduction, Factors affecting crack width in beams, Mechanisms of flexural cracking, Calculation of crack width, Simple empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking.

UNIT – II

Analysis and Design of Grid Floors: Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko's plate theory. Analysis of grid by stiffness matrix method, Analysis of grid floors by equating joint deflections, Comparison of methods of Analysis, Detailing of steel in flat grids.

UNIT – III

Analysis and Design of flat slabs: Introduction, Proportioning of flat slabs, Determination of bending moment and shear force, the direct design method, Equivalent frame method, slab reinforcement details.

UNIT – IV

FIRE AND SEISMIC RESISTANCE OF CONCRETE STRUCTURES:

Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading or classifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Fire resistance by structural detailing from tabulated data, Analytical determination of the ultimate bending moment, Capacity of reinforced concrete beams under fire, Other considerations.

Ductile Detailing of Frames for Seismic Forces: Introduction, General principles, Factors that increase ductility, Specifications of materials for ductility, ductile detailing of beams – Requirements, Ductile detailing of columns and frame members with axial load (P) and moment (M) – Requirements. Shear walls, Joints in frames.

UNIT – V

Bunkers and Silos: Introduction, Design of rectangular bunkers, circular bunkers and silos

Chimneys: Introduction, Design factors, Stresses due to self weight, wind and temperature, Combinations of stresses.

TEXT BOOKS

1. Bhavikatti S. S. *"Advance RCC Design"*, 3rd Edition, New Age International Private Limited, 2008
2. Krishnam Raju, N. *"Design of Reinforced Concrete Structures",* 2nd Edition, CBS Publishers and Distributors, New Delhi, 2007.

REFERENCES

1. Varghese P.C. *"Advanced Reinforced Concrete Design",* 2nd Edition, Prentice - Hall of India, , 2008
2. Indian Standarad Code 456 2000, *"Code of Practice for plan & reinforced centre"*, British Standard Code-2000.
3. Special Publications -16, *"Design Aids for Reinforced Concrete*", to Is: 456.

4. Purushothaman,P., *"Reinforced Concrete Structural Elements"*, 3rd Edition, Tata Mc Graw- Hill Publishing Co, 2004.
5. Pillai and Devadas Menon, *"Reinforced Concrete Design"*, 2nd Edition, Tata McGraw Hill Publishing Co. Ltd., 2003.

STRUCTURAL OPTIMIZATION

Course Code: 13CE 2202

L	P	C
4	0	3

Course Outcomes:

At the end of the course the student will be able to

CO1 : Describe problem formulation for a given structure and learn to analysis by classical methods.
CO2 : Prepare solutions for non-linear problems.
CO3 : Discuss the basics and application of Genetic Algorithm for structurs.
CO4 : Explain the concept of Simulated Annealing technique in structurs.
CO5 : Use Artificial Neural Networks in structural application.

UNIT – I

Formulation of Structural Optimization problems: Design variables - Objective function – constraints.

Classical methods of optimization for multivariable with equality or inequality constraints: solution by method of Lagrange Multiplier - Applications in structural engineering, Kuhn-Tucker conditions.

UNIT – II

Nonlinear Programming: Unconstrained and Constrained Optimization - Direct search and gradient methods- Basic approach of the Penalty function method - Interior penalty function method and Exterior penalty function method – design of three bar truss, space truss, welded beam design, etc.

UNIT – III

Genetic Algorithms: – Introduction – basic concept – working principle - Binary coding- Fitness function - Genetic Operators - Application to Two bar pendulum, 3-bar truss, optimum fibre orientation, Genetic Algorithms applications to discrete size variables.

UNIT – IV