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Course Details

Course Code **L T P C**

SB8004 1 0 2 2

PRE-REQUISITE

?Fundamentals of RCC elements design
?Basic exposure on analysis software
?Familiarity on IS codes, standards, and handbooks

COURSE LEARNING OBJECTIVES

- The course will present concepts and practical aspects of design & construction of reinforced concrete buildings particularly those about 10 storeys tall and less than 50 meters in height.

KEY JOB ROLES

?Design Engineer
?Site Planning Engineer
?Construction Engineer
?R&D Engineer
?Design Consultant

OVERVIEW

The course provides key design techniques and practical application aspects from L&T's decades of expertise in designing structures. The course takes the learner through the typical process in designing reinforced concrete buildings particularly those about 10 storeys tall and less than 50 meters in height. This

advanced course provides the experience of designing reinforced concrete buildings as it happens in any design office. The course covers schematic design of gravity and lateral load resisting systems in a reinforced concrete building, when to choose a particular system and how to size various components (slabs, beams, columns, shear walls). It also includes calculation of loads and analysis of structure, design and detailing of reinforcement in various components in a hands-on manner.

SYLLABUS

UNIT I - INTRODUCTION AND CODES- DESIGN BASIS PARAMETERS AND REPORT (3T+6P)

- Indian & International Codes for Reinforced concrete Design, Design loads and detailing of reinforcement, Handbooks for reinforced concrete design, National Building Code 2016, Practical building examples, drawing sizes and scales, Reading Drawings ? Architectural & Structural.
- Introduction to DBR Parameters - Geometric Parameters, Occupancy Categories, Site location and associated parameters, Design life of structures, Material Specifications - Grade of concrete for vertical and floor elements ? Grade of reinforcing steel, Exposure and cover requirements, Fire rating requirements, Load Combinations, Serviceability Requirements, Analysis tools, Design Basis Report, Concept explanation with example buildings.

UNIT II - LOADS & SETTING THE STRUCTURAL SCHEME (3T+6P)

- Introduction, dead loads, superimposed dead loads, Live loads, Wind loads, Wind pressure coefficients, Determining global wind forces and wind velocity, storey forces and base shears. Earthquake loads, response spectrum to earthquake excitation, seismic design parameters - horizontal acceleration coefficient, Time period, Evaluation and application of seismic base shear, equivalent static method. Loads due to pressure ? earth pressure, hydrostatic pressure. Loads from MEP Services and architectural considerations like façade loads.
- Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Dimensioning & designing of drop panels, Beams, Reinforced Concrete Columns - Location and Shape, Design Axial Load, Sizing, Lateral Load Systems, IS 1893- Requirements, Shear Walls ? Location and thickness. Estimating relative stiffness of core walls.

UNIT III - STRUCTURAL MODELS (3T+6P)

- Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining wind loads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Direct design method for Flat Slabs, Analysis of two-way slabs using moment coefficient method, Application of moment coefficient method, Estimation of deflections.
- ETABS software demonstration for correct modelling and design of Vertical and Lateral loading systems like Shear Walls

UNIT IV - DESIGN OF STRUCTURAL ELEMENTS (3T+6P)

- Design of structural elements - Design of Beams- flexural reinforcement, shear reinforcement-design of edge beam, Practical examples, Design of flat slabs- Flexural Reinforcement, shear reinforcement- Practical Examples-Design of mesh reinforcement, additional bottom reinforcement, additional top reinforcement, Design of 2-way continuous slabs.
- Design of Reinforcements in Columns - Post processing of column forces from analysis, Design and arrangement of vertical reinforcement, Design of horizontal reinforcement, Design of stirrups, Cardinal rules in scheme design of buildings, Coordination with other Engineering disciplines

HIGH_RISE_BUILDING_DESIGN

Design of shear walls ? General considerations, Seismic response of RC structures, Vertical and Horizontal Reinforcement, Calculation of design forces, moment capacity of vertical distributed reinforcement, Design of boundary elements and boundary zone. Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilization.

UNIT V - DETAILING OF STRUCTURAL ELEMENTS- BILL OF QUANTITIES AND CONCLUSION (3T+6P)

- Development length of rebars, detailing of various structural elements - flat slabs, two-way continuous slabs, beams, columns and shear wall, detailing and documentation of practical example building.
- Bill of quantities - Concrete and steel indices for RC buildings, Reinforcement consumption in RC members, BoQ of practical example building.

TOTAL: 45 PERIODS

CASE STUDIES

?Structural analysis, design and detailing of a multi-storey building with load calculation (dead, live, wind and seismic) as per Indian standard codes using ETABS
?Bill of Quantities preparation of the multi storey building structure.

ATTAINMENT OF LEARNING OUTCOMES STUDENT ASSESSMENT PLAN

1. The conceptualisation and comprehension level of learning outcomes intended through the course is measured through assessments conducted in multiple stages.
2. The understanding of concepts & principles, evolution of practices, codes & guidelines, emerging trends etc. are tested through assessment questions.
3. The skill outcome related to design, computation, workflow, report & work plan

preparation, implementation etc. are assessed through assignments. Such assignment questions & answer keys will be shared to the college SPOC for enabling evaluation by respective faculties.

STUDENT ASSESSMENT 1

Preparation of a Design Basis Report for a reinforced concrete building considering site specific parameters and loading due to functionality, computation of wind speed and pressure, seismic parameters, load combinations, grid planning and structural systems.

STUDENT ASSESSMENT 2

Students will have to model a reinforced concrete building in ETABS by identifying regional seismic and wind load from appropriate code provisions and designing typical structural elements for the critical load combination.

SOFTWARE EXPOSURE

Learners are exposed to ETABS software for 40% of course duration for analysis and design of complete

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RCC building including modelling, specifications, loads and combination of loads. The students can use free student version of this software post completion of the course.

COURSE OUTCOMES

On completion of the course, the students will be able to-

?**LO1.:** Model a 14-storey building for given location and loading conditions such as wind, seismic and combined loads.

?**LO2.:** Prepare a Design Basis Report for a multi storey building considering site parameters, MEP services and functionality.

?**LO3.:** Compute loads including wind and Seismic and selection of vertical and lateral load resisting systems