PRECAST TECHNOLOGY
(Job Oriented Elective – II)

Course Code: 20CE11Q3

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Pre-requisites: Building Materials and Concrete Technology, Structural Analysis, Design of Reinforced Concrete Structures

Course Outcome:

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

CO1: Describe the principles of prefabrication and material required for Precast Technology (L2)

CO2: Analyse a frame for the given loads (L4)

CO3: Design precast concrete slab, beam and column (L3)

CO4: Design precast concrete walls and connection system (L3)

CO5: Describe the precast production technology and its application (L2)

UNIT-I **(10 Lectures)**

INTRODUCTION:

Detailed description of Precast Concrete Construction. Difference between Precast and other forms of Concrete construction - Advantages of this form of construction - Need for Prefabrication: Principles of prefabrication, Comparison with cast-in-situ construction, types of prefabrication, automation in manufacturing of precast elements, Modular Coordination, Standardization, Transportation considerations, Erection systems, Materials in Precast Structures – Mix design, Steel reinforcement, Structural steel, welding, inserts and bolts.

Learning outcomes:

At the end of the unit, the student will be able to

1. Discuss the advantage of precast systems (L2)
2. Describe the challenges involved in transportation and erection of precast system (L2)
3. Explain the principles of prefabrication (L2)

UNIT-II **(10 Lectures)**

STRUCTURAL CONCEPTS OF PRECAST CONCRETE SYSTEMS:

Loads, Load path, Limit states, Precast Concrete building systems, Pre-cast frame analysis, Overview of the Structural Ties, analysis of handling and erection stresses.

NON-STRUCTURAL PRECAST ELEMENTS:

Paver blocks, fencing poles, transmission poles, manhole covers, hollow and solid blocks, door and window frames and curb stones.

Learning outcomes:

At the end of the unit, the student will be able to

1. Describe the load path in precast concrete building systems (L2)
2. Analyze a precast frame for given loads (L4)
3. Analyze non-structural precast elements (L4)

UNIT-III **(10 Lectures)**

DESIGN OF SLABS, BEAMS AND COLUMNS:

Precast Concrete slabs: Precast concrete flooring options, flooring arrangements, Structural design (flexural capacity, shear capacity, bearing capacity)

Precast Concrete Beams: Types of precast beams, Construction methods, loading arrangements, beam behaviour, Composite & Non composite reinforced concrete beams

Precast Concrete Columns: Geometry, Strength and General requirements. Overview of the design requirements

Learning outcomes:
At the end of the unit, the student will be able to
1. Design a precast concrete slab for a given loading (L3)
2. Design a precast concrete beam for a given loading (L3)
3. Design a precast concrete column for a given loading (L3)

UNIT-IV

DESIGN OF WALLS AND CONNECTIONS: (10 Lectures)

Precast Concrete walls: Functions, Types of precast concrete walls (infill shear walls), Distribution of horizontal loadings.

Precast Concrete Connections: Design, Manufacturing & construction considerations, Types of connections, expansion joints in precast construction, provisions for non-structural fastenings.

Learning outcomes:
At the end of the unit, the student will be able to
1. Discuss the types of precast walls (L2)
2. Design a precast concrete wall for a given loading (L3)
3. Design a concrete connection between any two elements (L3)

UNIT-V

PRODUCTION AND HOISTING TECHNOLOGY: (10 Lectures)

Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening.

Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

Learning outcomes:
At the end of the unit, the student will be able to
1. Discuss the precast production technology (L2)
2. Explain for erection of different types of members (L2)
3. Describe the equipment required for hoisting and erection of precast members (L2)

Text Books:

1. Kim S. Elliot, "Precast Concrete Structures" 2nd Edition, CRC Press, Taylor & Francis Group. 2017.

References:

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.
2. The Structural Precast Concrete Handbook 2nd Edition, ISBN : 981-04-3609-2, Building and Construction Authority, May 2001.
3. Mokk. L, "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 1964.
4. Hass, A. M. Precast Concrete Design and Applications, Applied Science Publishers, 1983.