Program : **Diploma in Civil Engineering**	
Course Code : **5014C**	Course Title: **Precast and prestressed concrete**
Semester : **5**	Credits: **3**
Course Category: **Program Elective**	
Periods per week: **3** (**L:3, T:0, P:0**)	Periods per semester: **45**

Course Objectives:

- To enable students to identify the various types modular construction of precast and prefabricated concrete elements, have the knowledge of the construction methods using these elements.
- To discuss advantages and disadvantages.
- To demonstrate prestressing methods, systems for Reinforced Concrete members.
- To emphasize the issues involved in design of prestressing system and loss of prestressing

Course Prerequisites:

Topic	Course code	Course name	Semester
Simple Bending theory		Theory of structures	3

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Identify relevant precast concrete element for a given type of construction	10	Understanding
CO2	Identify the components of prefabricated structures and recognize the relevance of prefab elements in a given situation	11	Understanding
CO3	Select relevant methods/systems of prestressing for a relevant construction work	11	Applying
CO4	Identify and sketch the suitable cable profile for a given prestressed concrete members.	11	Applying
	Series Test	2	

CO - PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	3		3				
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Identify relevant precast concrete element for a given type of construction**		
M1.01	Discuss the Advantages and disadvantages of precast concrete members	1	Understanding
M1.02	Identify the components of precast elements as per relevant BIS specifications	2	Understanding
M1.03	Describe Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles	3	Understanding
M1.04	Describe the Testing procedures of Precast components as per BIS standard	4	Understanding
Contents: Advantages and disadvantages of precast concrete members Non-structuralPrecastelements - Paverblocks, FencingPoles, TransmissionPoles, Man-hole Covers, Hollow and Solid Blocks, kerb stones as per relevant BIS specifications Structural Precast elements - tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles Testing of Precast components as per BIS standards			
CO2	**Identify the components of prefabricated structures and recognize the relevance of prefab elements in a given situation**		
M2.01	Identify the precast structural building components	2	Understanding
M2.02	Discuss the material characteristics and its Standard specifications	3	Understanding

M2.03	Explain Modular co-ordination, modular grid, and finishes, prefab systems, structural schemes and design considerations Prefab systems	3	Understanding
M2.04	Discuss the basics of prestressing	3	Understanding
	Series Test – I	1	

Contents:

Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, stair case elements,

Prefabricated building using precast load bearing and non-load bearing wall panels, floor systems - Material characteristics, Plans &Standard specifications

Modular co-ordination, modular grid, and finishes

Prefab systems and structural schemes and their classification including design considerations

Joints - requirements of structural joints and their design considerations

Manufacturing, storage, curing, transportation and erection of above elements, equipment needed

Principles of pre-stressed concrete and basic terminology.

Applications, advantages and disadvantages of prestressed concrete

Materials used and their properties, Necessity of high-grade materials

Types of Pre-stressing steel - Wire, Cable, tendon, Merits - demerits and applications

CO3	**Select relevant methods/ systems of prestressing for a relevant construction work**		
M3.01	Discuss the methods of prestressing	2	Understanding
M3.02	Identify the systems of prestressing	3	Understanding
M3.03	Determine the losses in prestressing during the process of prestressing	3	Applying
M3.04	Discuss BIS recommendations and interpret its practical applications	3	Understanding

Contents:

Methods of prestressing - Internal and External pre-stressing, Pre tensioning and Post tensioning-applications

Systems for pre tensioning - process, applications, merits and demerits - Hoyersystem

Systems for post-tensioning - process, applications, merits and demerits - Freyssinet system, MagnelBlaton system, Gifford Udallsystem.

Prestressing force in Cable, Loss of prestress during the tensioning process - loss due to friction, length effect, wobbling effect and curvature effect, (Simple Numerical problems to determine loss of pre-stress), Loss of pre-stress at the anchoring stage.

Loss of pre-stress occurring subsequently: losses due to shrinkage of concrete, creep of concrete, elastic shortening, and creep in steel, (Simple Numerical problems to determine loss of pre-stress).

BIS recommendations for percentage loss in case of Pre and Posttensioning

CO4	**Identify and sketch the suitable cable profile for a given prestressed concrete members.**		
M4.01	Discuss the cable profile for prestressing	2	Understanding
M4.02	Explain the Effect of cable profile on maximum stresses at mid span and at support.	3	Understanding
M4.03	Determination of maximum stresses at mid spans with linear cable profile	3	Applying
M4.04	Explain the steps involved in the design of simply supported rectangular beam sections	3	Understanding
	Series Test – II	1	

Contents:

Basic assumptions in analysis of pre-stressed concretebeams.

Cable Profile in simply supported rectangular beam section - concentric, eccentricstraight and parabolic

Effect of cable profile on maximum stresses at mid span and atsupport.

Numerical problems on determination of maximum stresses at mid spans with linear (concentric and eccentric) cable profilesonly.

Simple steps involved in Design of simply supported rectangular beam section (No numerical problems)

Text / Reference:

T/R	Book Title/Author
T1	Krishna Raju, N., Pre-stressed Concrete, Tata McGraw Hill, NewDelhi
R1	Shrikant B. Vanakudre, Prestressed Concrete, Khanna Publishing House, NewDelhi
R2	Marzuki,NorAshikin,PreCastandPreStressTechnology:Process,MethodandFutureTech- nology, CreatespaceIndependentPublication.
R3	Indian Concrete Institute., Handbook on Precast Concretebuildings
R4	BIS, New Delhi. IS 12592 Precast Concrete Manhole Coverand Frame, BIS, NewDelhi
R5	BIS, New Delhi. IS 15916 Building Design and Erection Using Prefabricated Concrete - Code of Practice, BIS, NewDelhi
R6	BIS,NewDelhi.IS15917BuildingDesignandErectionUsingMixed/CompositeConstruction- Code of Practice, BIS, New Delhi
R7	BIS,NewDelhi.IS458PrecastConcretePipes(withandwithoutreinforcement) - Specification, BIS, NewDelhi

Online Resources:

Sl.No	Website Link
1	http://www.understandconstruction.com/precast-concrete-construction.html#:~:text=Precast%20concrete%20is%20an%20alternative,resting%20place%20and%20fixed%20securely.
2	http://www.iitk.ac.in/ce/test/TestingProtocol_Pre-Cast%20Structural%20Components.pdf
3	http://icivil-hu.com/Civil-team/5th/prestressed/Dr.%20Hazim%20Slides/Lecture%202.1%20-%20Methods%20of%20Prestressing.pdf
4	https://www.icevirtuallibrary.com/doi/full/10.1680/pc.51775.0002
5	https://www.sanfoundry.com/prestressed-concrete-structures- cable-profile-cable-layout/#:~:text=Explanation%3A%20In%20a%20prestressed%20concrete,%3D%202e%CE%B4%2Fl%20Ec.