

PRESTRESSED CONCRETE

Lectures / Tutorials : 4 Periods/Week

Sessional marks : 40

Semester End Exam. : 3 Hours

Semester End Exam. marks : 60

Credits: 4

Course objectives:

- To introduce pre-stressed concrete and its materials
- To explain the various pre-stressing techniques
- To analyse a pre-stressed concrete beam
- To study the losses in pre-stress
- To determine the deflection of a pre-stressed concrete beams
- To design pre-stressed concrete beam for bending moment and shear force
- To determine bond and anchorage stresses and to design end block

Course outcomes:

- Learn the basic concept of pre-stressing of concrete and various pre-stressing systems
- Able to analyse and design pre-stressed concrete beams
- Able to estimate the losses in pre-stressing
- Able to design pre-stressed concrete beams including the end block

UNIT – I

Introduction

Basic concepts of prestressing; Historical development; Need for High strength steel and high strength concrete; Advantages of prestressed concrete.

Materials for Prestressed Concrete

High strength concrete; High tensile steel

Prestressing Systems

Tensioning devices; Hoyer's long line system of pretensioning; Post tensioning systems; detailed study of Freyssinet system, Lee-McCall System and Gifford – Udall system

Analysis of Prestress and Bending Stresses

Basic assumptions; Analysis of prestress; Resultant stresses at a section; Pressure (Thrust) line and internal resisting couple; Concept of Load balancing; Stresses in tendons; Cracking moment.

UNIT – II

Losses of Prestress

Nature of losses of prestress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

Deflections of Prestressed Concrete Members

Importance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members

UNIT-III

Flexural strength of prestressed concrete sections:

Types of flexural failure; Flexural strength of prestressed concrete sections as per IS1343: 1980

Design of sections for flexure as per IS1343: 1980

Introduction; Design loads and strengths; Strength and serviceability limit states; Minimum section modulus; Prestressing force; Limiting zone for the prestressing force; Design of rectangular and I sections for the limit state of collapse in flexure.

UNIT – IV

Shear Resistance

Shear and Principal Stresses; Ultimate shear resistance of prestressed concrete members and design of shear reinforcement as per IS1343 : 1980

Transfer Of Prestress In Pre-Tensioned Members & Flexural Bond Stresses

Transmission of prestressing force by bond; Transmission length; Bond stresses; Transverse tensile stresses; End zone reinforcement; Flexural bond stresses in pre – tensioned and post – tensioned grouted beams.

Anchorage Zone Stresses In Post-Tensioned Members

Stress distribution in end block; Anchorage zone stresses and Anchorage zone Reinforcement as per IS1343 : 1980

NOTE

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXT BOOK

Prestressed Concrete by N. Krishna Raju; 4th Edition, Tata Mc Graw - Hill Publishing Company Limited, 2012.

REFERENCE BOOKS

1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns, 3rd Edition, John Wiley & Sons, 2010.
2. Prestressed Concrete by Pandit & Gupta, CBS Publishers, 1995.
3. Fundamentals of Pre-stressed concrete by NC Sinha and SK Roy, 3rd Edition, S.Chand Publishers, 1985.
4. Prestressed Concrete by N.Raja Gopalan, 2nd Edition, Narosa Publishing House, 2008.