**E.G.S. PILLAY ENGINEERING COLLEGE, NAGAPATTINAM.**

**DEPARTMENT OF CIVIL ENGINEERING**

**COURSE PLAN**

**COURSE CODE : CE 6702 COURSE NAME :** **PRESTRESSED CONCRETE STRUCTURES**

**SEMESTER : VIII SEM. CIVIL. ENGG. – A&B SECTIONS ACADEMIC YEAR: 2016-2017**

**COURSE DURATION: JUN – NOV 2016 CLASS ROOM : PG 301 & PG 207**

**FACULTY DETAILS: Ms. M. Subita Deeneshwari, Asst.Prof/Civil Engg.**

|  |  |
| --- | --- |
| **PURPOSE** | To impart Knowledge about method of prestressing in concrete structures |
| **PREREQUISITE** | Structural concrete design |
| **INSTRUCTIONAL OBJECTIVES** | 1.Be able to perform analysis and design of prestressed concrete members and connections.  2. Be able to identify and interpret the appropriate relevant industry design codes  3. To become familiar with professional and contemporary issues in the design and fabrication of prestressed concrete members. |
| **COURSE OUTCOME(COs)** | After completion of this course, students can able to  1.Illustrate the behaviour of prestressed concrete beams and slab  2.Demonstrate tendon layout design, which satisfy the strength and serviceability limit states as required by design standards  3. Explain the analysis of anchorage zone stress and end block for prestressed concrete structures  4.Develop the design of prestressed composite beam.  5. Apply the recent techniques in prestressed concrete technology. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Course designed by | | Anna University, Chennai, Regulation 2013 | | | | |
| 1 | Category | | GENERAL  (G) | BASIC SCIENCES  (B) | ENGINEERING SCIENCES  AND TECHNICAL ART  (E) | **PROFESSIONAL**  **SUBJECTS**  **(P)** |
|  |  |  | **x** |
| 2 | Broad area | | Construction | **Structural** | Geotechnical | Environmental |
|  | **x** |  |  |
| 3 | Course co-coordinator | | | | Ms. M. Subita Deeneshwari | |

**Direct assessment details**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of assessment** | **Internal Marks** | **Topics** | **Duration** |
| Unit Test | 20 | Unit I | 2 periods |
| Daily Test 1 | Unit II | 1 period |
| Daily Test 2 | Unit III | 1 period |
| Daily Test 3 | Unit IV | 1 period |
| Cycle Test -1 | II & III Units | 3 Hrs |
| Cycle Test -2 | IV & V Units | 3 Hrs |
| Model Exam | Entire Syllabus | 3 Hrs |
| Assignments |  | Entire Syllabus |  |
| Innovative Assignment | Content Beyond Syllabus |  |
|  |  |  |  |
| Total | 20 |  |  |

**DETAILED LESSON PLAN**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UNIT I : INTRODUCTION – THEORY AND BEHAVIOUR**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr** | **0 Hr** | | | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | | **Instruction Delivery** | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** | |
| **Method** | | **Teaching Aids** | **Level** | |
| **1** | Basic concepts | | Lecture with discussion | | PPT, Video, Board & Chalk | Understand | | Tests, Assignments | | Be able to identify and interpret the appropriate relevant industry design codes. | | (CO1)  Illustrate the behaviour of prestressed concrete beams and slab | |
| **2** | Advantages – Materials required – Systems and methods of prestressing | |
| 3 | Analysis of sections – Stress concept – Strength concept – Load balancing concept | |
| 4 | Effect of loading on the tensile stresses in tendons | |
| 5 | Effect of tendon profile on deflections | |
| 6 | Factors influencing deflections | |
| 7 | Calculation of deflections | |
| 8 | Short term and long term deflections | |
| 9 | Losses of prestress | |
| **CUMULATIVE HOURS = LECTURE - 9, TUTORIAL – 0** | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **UNIT II: DESIGN FOR FLEXURE AND SHEAR**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per I.S.1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on I.S. 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code | | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** |
| **Method** | | **Teaching Aids** | | | **Level** | |
| **1** | Basic assumptions for calculating flexural stresses | Lecture with discussion | | PPT, Video, Board & Chalk | | | Applying | | Tests,  Assignments | |  | | (CO2) Demonstrate tendon layout design, which satisfy the strength and serviceability limit states as required by design standards |
| **2** | Permissible stresses in steel and concrete as per I.S.1343 Code |
| **3** | Design of sections of Type I and Type II post-tensioned and pre-tensioned beams |
| **4** | Check for strength limit based on I.S. 1343 Code |
| **5** | Layout of cables in post-tensioned beams |
| **6** | Location of wires in pre-tensioned beams |
| **7** | Design for shear based on I.S. 1343 Code. |
| **8** | calculating flexural stresses |
| 9 | I.S. 1343 Code |
| **CUMULATIVE HOURS = LECTURE - 18, TUTORIAL – 0** | | | | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UNIT III: DEFLECTION AND DESIGN OF ANCHORAGE ZONE**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   . | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Factors influencing deflections | Lecture with discussion | PPT, Video, Board & Chalk | Applying | Tests,  Assignments | 1. Be able to perform analysis and design of prestressed concrete members and connections. | (CO3)  Explain the analysis of anchorage zone stress and end block for prestressed concrete structures |
| **2** | Short term deflections of uncracked members |
| **3** | Prediction of long term deflections due to creep and shrinkage |
| **4** | Check for serviceability limit state of deflection |
| **5** | Determination of anchorage zone stresses |
| **6** | post-tensioned beams by Magnel‟s method |
| **7** | Guyon‟s method and IS1343 code |
| **8** | design of anchorage zone reinforcement |
| 9 | Check for transfer bond length in pre-tensioned beams |
| **CUMULATIVE HOURS = LECTURE - 27, TUTORIAL – 0** | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UNIT IV: COMPOSITE BEAMS AND CONTINUOUS BEAMS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** | | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | | **Instruction Delivery** | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** |
| **Method** | **Teaching Aids** | | **Level** | |
| **1** | Analysis of composite beams | | Lecture with discussion | PPT, Video, Board & Chalk | | understand | | Tests,  Assignments | |  | | (CO4)  Develop the design of prestressed composite beam. |
| **2** | Methods of achieving continuity in continuous beams | |
| **3** | Analysis for secondary moments | |
| 4 | Concordant cable | |
| 5 | linear transformation | |
| **6** | Calculation of stresses | |
| **7** | Principles of design. | |
| 8 | design of composite beams | |
| 9 | IS1343 code | |
| **CUMULATIVE HOURS = LECTURE - 36, TUTORIAL – 0** | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **UNIT V: MISCELLANEOUS STRUCTURES**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing. | | | | | | | | | | | | |
| **Session No** | | **Topics to be covered** | **Instruction Delivery** | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** | |
| **Method** | | **Teaching Aids** | **Level** |
| **1** | | Progressive collapse | Lecture with discussion | | PPT, Video, Board & Chalk | Apply | Tests,  Assignments | |  | | (CO5)  Apply the recent techniques in prestressed concrete technology. | |
| **2** | | Code provisions |
| **3** | | Equivalent design loads for considering abnormal effects such as earthquakes |
| 4 | | Ductile detailing |
| **5** | | Improving cyclone resistance of building |
| **6** | | Importance of avoidance of progressive collapse. |
| 7 | | Masonry walls of good design |
| 8 | | Framed buildings |
| 9 | | Earthen walls |
| **CUMULATIVE HOURS = LECTURE - 45, TUTORIAL – 0** | | | | | | | | | | | | |

**Text / Reference Books**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Title of the Book** | **Author(s)** | **Publisher** |
| **TEXT BOOKS** | | | |
| T1 | Prestressed concrete | Krishna Raju N | 5th Edition, Tata McGraw Hill Company, New Delhi, 2012 |
| T2 | Prestressed Concrete | Pandit.G.S. and Gupta.S.P | CBS Publishers and Distributers Pvt. Ltd, 2012. |
| **REFERENCES** | | | |
| R1 | Prestressed Concrete", | Rajagopalan.N | Narosa Publishing House, 2002 |
| R2 | "Prestressed Concrete Structures", | Dayaratnam.P | Oxford and IBH, 2013 |
| R3 | "Design of prestressed Concrete Structures" | Lin T.Y. and Ned.H.Burns | Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013 |
| R4 | Code of Practice for Prestressed Concrete, | IS1343:1980 | Bureau of Indian Standards, New Delhi, 2012 |
| **REFERENCE WEBSITES** | | | |
| 1 | [http://www.**nptel**.ac.in/courses/105106117/pdf/9\_Special\_Topics/Section9.1.pdf](http://www.nptel.ac.in/courses/105106117/pdf/9_Special_Topics/Section9.1.pdf) | | |

**GAP ANALYSIS:**

To satisfy the

Course Outcome number (2) (Explain the various connections in prefabricated structures)

&

Course Outcome number (3) (Apply the principles and systems of prefabrication in the field),

content beyond syllabi to be exposed to the student through innovative assignment.

**CONTENT BEYOND SYLLUBI:**

Assignments forthe following topics:

1. Case study – low cost housing solutions
2. Case studies on problems in joints

**COURSE INCHARGE**

**Programme Name: B.E. Civil Engineering**

**Programme Educational Objectives (PEOs):**

I : Graduates will actively engage in problem solving using engineering principles to address the evolving needs of the society.

II: Graduates will have successful career in civil engineering practice and research activities.

III: Graduates will serve the society with professional ethics and integrity.

**Programme Outcomes (POs): Graduates will be able to**

(PO1) Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(PO2) Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

(PO3) Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

(PO4) Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

(PO5) Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

(PO6) Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

(PO7) Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

(PO8) Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

(PO9) Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

(PO10) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO11) Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(PO12) Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

**Programme Specific Outcomes (PSOs): Graduates will able to**

PSO1. Apply appropriate methodology for geotechnical, structural design and analysis, material selection, planning, scheduling estimation and costing, using modern tool in construction field.

PSO2. Service to the development of public health and environmental safety of the society with ethical values.

PSO3. Pursue lifelong learning and professional development to face challenging and emerging needs of the society.

**Mapping Table 1: COs of CE702: Prestressed concrete structures Vs POs**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course Outcomes (COs) | CO  level | Program Outcomes (POs) | | | | | | | | | | | |
| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| PO level |  | K3 | K4 | K5 | K5 | K6/k5/k4 |  |  |  |  |  |  |  |
| CO1 | K2 | 2 | 1 | - | - | - |  |  |  |  |  |  |  |
| CO2 | K3 | 2 | 1 | 1 | - | - |  |  |  |  |  |  |  |
| CO3 | K3 | 3 | 2 | 1 | - | - |  |  |  |  |  |  |  |
| CO4 | K2 | 3 | 2 | 1 | - | - |  |  |  |  |  |  |  |
| CO5 | K3 | 2 | 1 | - | - | - |  |  |  |  |  |  |  |

**Mapping Table 2: COs of CE6702: Prestressed concrete structures Vs PSOs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Course Outcomes (COs) | CO level | Program Specific Outcomes (PSOs) | | |
| PSO1 | PSO2 | PSO3 |
| PO level |  | K3 | K2 | K4 |
| CO1 | K2 | 2 | - | - |
| CO2 | K3 | 2 | - | - |
| CO3 | K3 | 3 | - | - |
| CO4 | K2 | 3 | - | 1 |
| CO5 | K3 | 2 | - | - |

**Note: Adequate Support by the COs to POs and PSOs: 3- High 2- Medium 1- Low**