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

**DEPARTMENT OF CIVIL ENGINEERING**

**COURSE PLAN**

**COURSE CODE : CE 6016 COURSE NAME :** **PREFABRICATED STRUCTURES**

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

**COURSE DURATION: JANUARY – MAY 2017 CLASS ROOM : PG 301 & PG 207**

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

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| **PURPOSE** | To impart Knowledge about Precast construction methods |
| **PREREQUISITE** | Structural concrete design |
| **INSTRUCTIONAL OBJECTIVES** | 1. To impart knowledge about the prefabricated structures and the technologies used in fabrication, erection and modular co-ordination . 2. To study the behavior, construction methods of various prefabricated structural components and know the problems involved in design of prefabricated elements. 3. To impart knowledge on the joints of prefabricated structural components 4. To study the design of prefabricated structures to dynamic forces and the codal provisions. |
| **COURSE OUTCOME(COs)** | After completion of this course, students can able to   1. Illustrate the design principles for prefabricated structures 2. Explain the various connections in prefabricated structures 3. Apply the principles and systems of prefabrication in the field 4. Identify suitable prefabricated components for specific use 5. Utilize the various code provisions regarding progressive collapse. |

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| 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**

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| **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**

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| **UNIT I : INTRODUCTION**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr** | **0 Hr** |   Need for prefabrication – Principles – Materials – Modular coordination – Standardization –Systems – Production – Transportation – Erection. | | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | | **Instruction Delivery** | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** | |
| **Method** | | **Teaching Aids** | **Level** | |
| **1** | Need for prefabrication | | Lecture with discussion | | PPT & Videos | Understand | | Tests, Assignments | | 1. To impart knowledge about the prefabricated structures and the technologies used in fabrication, erection and modular coordination . | | (CO1) Illustrate the design principles for prefabricated structures | |
| **2** | Principles of prefabrication | |
| 3 | Materials for prefabrication | |
| 4 | Modular coordination of prefabricated components | |
| 5 | Bases and aim of modular co-ordination | |
| 6 | Standardization of Systems | |
| 7 | Production of prefabricated components | |
| 8 | Transportation of prefabricated structures | |
| 9 | Erection of prefabricated structures (video) | |
| **CUMULATIVE HOURS = LECTURE - 9, TUTORIAL – 0** | | | | | | | | | | | | | |
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| **UNIT II: PREFABRICATED COMPONENTS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls | | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** |
| **Method** | | **Teaching Aids** | | | **Level** | |
| **1** | Behaviour of structural components | Lecture with discussion | | PPT & Videos | | | Applying | | Tests,  Assignments | | 1. To study the behavior, construction methods of various prefabricated structural components and know the problems involved in design of prefabricated elements. | | (CO4) Identify suitable prefabricated components for specific use |
| **2** | Large panel constructions |
| **3** | Construction of roof and floor slabs |
| **4** | Case study –low cost housing solution |
| **5** | Types and concepts of precast system |
| **6** | Wall panels |
| **7** | Shear wall |
| **8** | Columns |
| 9 | Architectural aspects of Shear walls |
| **CUMULATIVE HOURS = LECTURE - 18, TUTORIAL – 0** | | | | | | | | | | | | | |

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| **UNIT III: DESIGN PRINCIPLES**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Disuniting of structures- Design of cross section based on efficiency of material used –Problems in design because of joint flexibility – Allowance for joint deformation. | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Disuniting of structures | Lecture with discussion | PPT & Videos | Applying | Tests,  Assignments | 1. To study the behavior, construction methods of various prefabricated structural components and know the problems involved in design of prefabricated elements. | (CO3) Apply the principles and systems of prefabrication in the field |
| **2** | Design of cross section based on efficiency of material used |
| **3** | Dimensioning of joint |
| **4** | Problems in design because of joint flexibility |
| **5** | Design of expansion joint |
| **6** | Allowance for joint deformation |
| **7** | Selection criteria for modular joints and strip seals, silicone seals |
| **8** | Structure and joining of prefabricated member |
| 9 | CASE Studies |
| **CUMULATIVE HOURS = LECTURE - 27, TUTORIAL – 0** | | | | | | | |

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| **UNIT IV: JOINT IN STRUCTURAL MEMBERS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Joints for different structural connections – Dimensions and detailing – Design of expansion joints | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | | **Instruction Delivery** | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** |
| **Method** | **Teaching Aids** | | **Level** | |
| **1** | Joints for different structural connections | | Lecture with discussion | PPT & Videos | | understand | | Tests,  Assignments | | 1. To impart knowledge on the joints of prefabricated structural components | | (CO2)Explain the various connections in prefabricated structures |
| **2** | Connection detail | |
| **3** | Designing and connection | |
| 4 | Dimensions and detailing | |
| 5 | Joints for concrete | |
| **6** | Types of joints | |
| **7** | Materials for concrete joints | |
| 8 | Dowelled and Non- Dowelled joints | |
| 9 | Design of expansion joints | |
| **CUMULATIVE HOURS = LECTURE - 36, TUTORIAL – 0** | | | | | | | | | | | | |
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| **UNIT V: DESIGN FOR ABNORMAL LOADS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse. | | | | | | | | | | | | |
| **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 & Videos | Apply | Tests,  Assignments | | 1. To study the design of prefabricated structures to dynamic forces and the codal provisions | | (CO5) Utilize the various code provisions regarding progressive collapse. | |
| **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**

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| **Sl. No.** | **Title of the Book** | **Author(s)** | **Publisher** |
| **TEXT BOOKS** | | | |
| T1 | CBRI, Building materials and components, India, 1990 |  | CBRI, India, 1990 |
| T2 | Knowledge based process planning for construction and manufacturing | Gerostiza C.Z, Hendrikson C. and Rehat D.R | Academic Press Inc., 1994 |
| T3 | Prefabricated Structures | Ganesan . R and Latha.A , | Sree Kalamani Publication |
| **REFERENCES** | | | |
| R1 | Manual of precast concrete construction, Vols. I, II and III | Koncz T., | Bauverlag, GMBH,1971 |
| R2 | Structural design manual, Precast concrete connection details, |  | Society for the studies in  the use of precast concrete, Netherland Betor Verlag, 1978. |
| **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 (3) (Apply the principles and systems of prefabrication in the field)

&

1. Course Outcome number (4) (Identify suitable prefabricated components for specific use

),

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. Accelerated bridge construction using prefabricated elements

**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 CE6016: Prefabricated structures Vs POs**

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| 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 | K2 | 2 | 1 |  |  | - |  |  |  |  |  |  |  |
| CO3 | K3 | 3 | 2 | 1 |  | - |  |  |  |  |  |  |  |
| CO4 | K2 | 2 | 1 |  |  | - |  |  |  |  |  |  |  |
| CO5 | K2 | 2 | 1 |  |  | - |  |  |  |  |  |  |  |

**Mapping Table 2: COs of CE6016: Prefabricated structures Vs PSOs**

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

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