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

**DEPARTMENT OF CIVIL ENGINEERING**

**COURSE PLAN**

**COURSE CODE : CE6505 COURSE NAME :** **DESIGN OF RC ELEMENTS**

**SEMESTER : V SEM. CIVIL. ENGG. -B SECTION ACADEMIC YEAR: 2016-2017**

**COURSE DURATION : JULY – DEC 2017 CLASS ROOM : PG206**

**FACULTY DETAILS : J.Britto, Asst.Prof/Civil Engg.**

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| **PURPOSE** | To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice |
| **PREREQUISITE** | 1.Basic Mathematics  2.strength of materials |
| **INSTRUCTIONAL OBJECTIVES** | 1. To impart the design methods for reinforced concrete structure. 2. To impart the limit state method of design of the singly, doubly reinforced rectangular beams and RCslabs. 3. To impart the limit state method of design for bond, shear, anchorage of RC beams 4. To impart the limit state method of design of columns. 5. To impart the limit state method of design of footings |
| **INSTRUCTIONAL OUTCOME** | After completion of this course, students will able to  1.Explain the methods of RC design and list IS code books  2.Demonstrate Design of RC slab and beams by both working stress and limit state method  3.Make use of Design of beams for bond, anchorage, shear and torsion  4.Make use of Design of columns & footing by LIMIT STATE DESIGN  5.Examine the basic elements of RC structure |

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| Course designed by | | Anna University, Chennai(R-2013) | | | | | |
| 1 | Category | | GENERAL  (G) | BASIC SCIENCES  (B) | | ENGINEERING SCIENCES  AND TECHNICAL ART  (E) | **PROFESSIONAL**  **SUBJECTS**  **(P)** |
|  |  | |  | **x** |
| 2 | Broad area | | **Theory** | | Planning&Design | Estimation | **General** |
|  | | **x** |  |  |
| 3 | Course co-coordinator | | | | | Dr. R.Sivakumar | |

**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 |  |
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| Total | 20 |  |  |

**DETAILED LESSON PLAN**

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| **UNIT I: METHODS OF DESIGN OF CONCRETE STRUCTURES**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |     Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of flexural members and slabs by working stress method | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| 1 | Concept of Elastic method, ultimate load method and limit state method | Lecture with discussion | PPT,  BB & Chalk | Understand | Tests,  Assignments | To impart the design methods for reinforced concrete structure.  . | Explain the methods of RC design and list IS code books |
| 2 | Advantages of Limit  State Method over other methods |
| 3 | Design codes and specification |
| 4 | Limit State philosophy as  detailed in IS code |
| 5 | Design of flexural members by working stress method |
| 6 | Derivation design constants |
| 7 | Under ,over and balanced section |
| 8 | Design of doubly reinforced beam |
| 9 | Design of slab |
| **CUMULATIVE HOURS = LECTURE - 09, TUTORIAL - 0** | | | | | | | |

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| **UNIT II: LIMIT STATE DESIGN FOR FLEXURE**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Analysis and design of singly and doublyreinforced rectangular and flanged beams -Analysis and design of one way , two way and continuous rectangular slab subjected to uniformly distributed load for various boundary conditions. | | | | | | | | | | | | | |
| **Session No** | | **Topics to be covered** | **Instruction Delivery** | | | | | **Testing Method** | **Instructional objective** | | | **Course Outcome** | |
| **Method** | **Teaching Aids** | | **Level** | |
| 1 | | Introduction of slab, Types of slab | | Lecture with discussion | | PPT,  BB & Chalk | | Apply | Tests,  Assignments | | To impart the limit state method of design of the singly, doubly reinforced rectangular beams and RCslabs. | Demonstrate Design of RC slab and beams by both working stress and limit state method | |
| 2 | | Analysis and design of one way and two way rectangular slab subjected to uniformly distributedload | |
| 3 | | Design of two way slab for various boundary conditions and corner effects | |
| 4 | | Continuous salb | |
| 5 | | Analysis and design of singly reinforced beam | |
| 6 | | Analysis and design of doubly reinforced beam | |
| 7 | | Design of flanged beam-T beam | |
| 8 | | Design of flanged beam-L beam | |
| 9 | | Design of rectangular beam | |
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| **CUMULATIVE HOURS = LECTURE - 18, TUTORIAL - 0** | | | | | | | | | | | | | |

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| **UNIT III: STATE DESIGN FOR BOND, ANCHORAGE SHEAR & TORSION**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion Design of RC members for combined bending shear and torsion. | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| 1 | Introduction of shear | Lecture with discussion | PPT,  BB & Chalk | Apply | Tests,  Assignments | To impart the limit state method of design for bond, shear, anchorage of RC beams | Make use of Design of beams for bond, anchorage, shear and torsion |
| 2 | Behaviour of RC members in bond and Anchorage |
| 3 | Design requirements as per current code |
| 4 | Behaviour of RC beams in shear |
| 5 | Behaviour of RC beams in shear and torsion |
| 6 | Design of torision |
| 7 | Design of RC members for combined bending |
| 8 | Design of RC members for combined bending  shear and torsion. |
| 9 | Design of beam shear |
| **CUMULATIVE HOURS = LECTURE - 27, TUTORIAL - 0** | | | | | | | |

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| **UNIT IV: LIMIT STATE DESIGN OF COLUMNS**  Types of columns – Braced and un braced columns – Design of short column for axial, uni axial and biaxial bending.   |  |  |  | | --- | --- | --- | | **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 | Introduction of column | Lecture with discussion | PPT,  BB & Chalk | apply | Tests,  Assignments | To impart the limit state method of design of columns. | Make use of Design of columns & footing by LIMIT STATE DESIGN |
| 2 | Types of columns |
| 3 | Braced column |
| 4 | Un braced columns |
| 5 | Design of square short column for axial |
| 6 | Design of square circular column for axial |
| 7 | Design of short square column for uniaxial |  |  |  |  |  |  |
| 8 | Design of short rectangular column for uni axial |
| 9 | Design of short column biaxial bending |
| **CUMULATIVE HOURS = LECTURE - 36, TUTORIAL - 0** | | | | | | | |

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| **UNIT V: LIMIT STATE DESIGN OF FOOTING AND DETAILING**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footing – Design of combined rectangular footing for two columns only | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| 1 | Design of wall footing | Lecture with discussion | PPT,  BB & Chalk | Apply | Tests,  Assignments | To impart the limit state method of design of footings | Examine the basic elements of RC structure |
| 2 | Design of axially loaded rectangular pad footing |
| 3 | Design of axially loaded rectangular sloped footing |
| 4 | Design of eccentrically loaded rectangular pad footing |
| 5 | Design of eccentrically loaded rectangular sloped footing |
| 6 | Design of combined rectangular footing for two columns only |
| 7 | Designof combined trapezoidzl footing for two columns only |
| 8 | Design of combined rectangular footing for two columns only(square columns) |
| 9 | Design of combined rectangular footing for columns on the edge of footing |
| **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 | Design of Reinforced Concrete Structures | Krishna Raju.N | CBS Publishers & Distributors, New Delhi,2003 |
| T2 | Design of Reinforced Concrete Structures | Gambhir.M.L | Prentice Hall of India Private Limited, 2012. |
| T3 | Brick and Reinforced Brick Structures | Dayaratnam, P. | Oxford & IBH Publishing House, 1997 |
| **REFERENCES** | | | |
| R1 | Reinforced Concrete | Mallick, D.K. and Gupta A.P., | Oxford and IBH Publishing Company,1997 |
| R2 | Reinforced Concrete Structures | Syal, I.C. and Goel, A.K., | “A.H. Wheelers & Co. Pvt. Ltd., 1998 |
| **REFERENCE WEBSITES** | | | |
| 1 | <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/drcbms%20Proc%20II/> | | |
| 3 | <http://www.ce.iitb.ac.in/~sub/CE338/non_trad.pdf> | | |
| 4 | www.civilconstruction.com | | |

**GAP ANALYSIS:**

To satisfy the Course Objective number 1 (To impart design knowledge of Retaining walls)

& Course Outcome number (1) (Apply these design principles with confidence in field application to design Dams, Swimming pool, Compound walls and Bridge Abutments for the society), content beyond syllabi to be exposed to the student through value added courses on design software packages.

**CONTENT BEYOND SYLLUBI**:

1. ETABS.
2. STAAD.Pro.
3. BBS

**COURSE INCHARGE**

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

**Programme Educational Objectives (PEOs):**

PEO1: Graduates will actively engage in problem solving using engineering principles to address the evolving needs of the society.

PEO2: Graduates will have successful career in civil engineering practice and research activities.

PEO3: 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: Graduates will be able to apply appropriate methodology for geotechnical, structural design and analysis, material selection, planning, scheduling estimation and costing, using modern tool in construction field

PSO2: Graduates will be able to service to the development of public health and environmental safety of the society with ethical values.

PSO3: Graduates will be able to pursue lifelong learning and professional development to face challenging and emerging needs of the society.

**Mapping Table: COs of CE6601:DESIGN OF RC AND BM STRUCTURES Vs POs & PSOs**

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| Course Outcomes (COs) | Program Outcomes (POs) | | | | | | | | | | | |
| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 2 | 2 | 2 | 1 |  |  |  | 2 |  |  |  |  |
| CO2 | 2 | 2 | 2 | 1 |  |  |  | 2 |  |  |  |  |
| CO3 | 3 | 2 | 2 | 1 |  |  |  | 2 |  |  |  |  |
| CO4 | 3 | 2 | 2 | 1 |  |  |  | 1 |  |  |  |  |
| CO5 | 3 | 3 | 3 | 2 |  |  |  | 3 |  |  |  |  |

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| Course Outcomes (COs) | Program Specific Outcomes (PSOs) | | | |
| PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 |  |
| CO2 | 3 | 2 |  |
| CO3 | 3 | 2 |  |
| CO4 | 3 | 1 |  |
| CO5 | 3 | 2 |  |

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