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

**DEPARTMENT OF CIVIL ENGINEERING**

**COURSE PLAN**

**COURSE CODE : CE6401 COURSE NAME :** **CONSTRUCTION MATERIALS**

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

**COURSE DURATION : JANUARY – MAY 2017 CLASS ROOM : PG Block**

**FACULTY DETAILS : P. Malliga, Asso Prof/ Civil Engineering**

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| **PURPOSE** | To impart Knowledge about suitable materials used in construction |
| **PREREQUISITE** | Basic and Civil and Mechanical Engineering |
| **INSTRUCTIONAL OBJECTIVES** | 1. To study about the materials used for construction. 2. To understand the quality and need of quantity of materials for construction. 3. To clear description of testing of materials used for construction |
| **INSTRUCTIONAL OUTCOME** | After completion of this course, students can able to   1. Summarize the suitable material for construction. 2. Explain the manufacturing process of various building materials. 3. Conduct the tests for material properties and quality control of concrete. 4. Compare the nature and strength of concrete used in constructions. 5. Make use of modern materials for economic construction |

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| Course designed by | | Anna University, Chennai | | | | |
| 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 | | | | Mrs. P. Malliga | |

**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 : STONES – BRICKS – CONCRETE BLOCKS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr** | **0 Hr** |   Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks. | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | | **Instruction Delivery** | | | | **Testing Method** | **Instructional objective** | | **Course Outcome** | |
| **Method** | | **Teaching Aids** | **Level** |
| 1 | Stone as building material – Criteria for selection | | Lecture with discussion | | PPT & Videos | Knowledge | Tests, Assignments | 1. To study about the materials used for construction. | | (a) Summarize the suitable material for construction. | |
| 2 | Tests on stones – Deterioration and Preservation of stone work | |
| 3 | Bricks – Classification | |  |
| 4 | Manufacturing of clay bricks – Tests on bricks | |
| 5 | Compressive Strength – Water Absorption | |
| 6 | Efflorescence – Bricks for special use | |
| 7 | Refractory bricks | |
| 8 | Cement, Concrete blocks | |
| 9 | Light weight concrete blocks | |
| **CUMULATIVE HOURS = LECTURE - 9, TUTORIAL – 0** | | | | | | | | | | | |
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| **UNIT II: LIME – CEMENT – AGGREGATES – MORTAR**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grade Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Industrial byproducts – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking. | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** |
| **Method** | | **Teaching Aids** | | **Level** |
| **1** | Lime – Preparation of lime mortar | Lecture with discussion | | PPT & Videos | | Understand | Tests,  Assignments | | 1. To study about the materials used for construction. | | b) Explain the manufacturing process of various building materials |
| **2** | Cement – Ingredients– Manufacturing process |
| **3** | Types and Grade Properties of cement and Cement mortar– Hydration |
| **4** | Compressive strength – Tensile strength – Fineness |
| **5** | Soundness and consistency – Setting time – Industrial byproducts – Fly ash |
| **6** | Aggregates – Natural stone aggregates |
| **7** | Natural stone aggregates – Crushing strength – Impact strength |
| **8** | Flakiness Index – Elongation Index – Abrasion Resistance |
| 9 | Grading – Sand Bulking. |
| **CUMULATIVE HOURS = LECTURE - 18, TUTORIAL – 0** | | | | | | | | | | | |

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| **UNIT III: CONCRETE**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete. | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Concrete – Ingredients | Lecture with discussion | PPT & Videos | Understand | Tests,  Assignments | 2. To understand the quality and need of quantity of materials for construction | 1. Conduct the tests for material properties and quality control of concrete.   &  d) Compare the nature and strength of concrete used in constructions. |
| **2** | Manufacturing Process – Batching plants |
| **3** | Batching plants – RMC |
| **4** | Properties of fresh concrete – Slump – Flow and compaction Factor |
| **5** | Properties of hardened concrete |
| **6** | Compressive, Tensile and shear strength – Modulus of rupture – Tests |
| **7** | Mix specification – Mix proportioning – BIS method |
| **8** | High Strength Concrete and HPC – Self compacting Concrete |
| 9 | Other types of Concrete – Durability of Concrete. |
| **CUMULATIVE HOURS = LECTURE - 27, TUTORIAL – 0** | | | | | | | |

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| **UNIT IV: TIMBER AND OTHER MATERIALS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **09 Hrs.** | **0 Hr.** | **0 Hr.** |   Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens | | | | | | | | | | | | |
| **Session No** | **Topics to be covered** | | **Instruction Delivery** | | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** |
| **Method** | **Teaching Aids** | | **Level** | |
| **1** | Timber – Market forms | | Lecture with discussion | PPT & Videos | | Understand | | Tests,  Assignments | | 3. To clear description of testing of materials used for construction | | e) Make use of modern materials for economic construction |
| **2** | Industrial timber | |
| **3** | Plywood – Veneer – Thermacole | |
| 4 | Panels of laminates | |
| 5 | Steel – Aluminum and Other Metallic Materials | |
| **6** | Composition – Aluminium composite panel – Uses | |
| **7** | Market forms – Mechanical treatment | |
| 8 | Paints – Varnishes- Distempers | |
| 9 | Bitumens | |
| **CUMULATIVE HOURS = LECTURE - 36, TUTORIAL – 0** | | | | | | | | | | | | |
| **UNIT V: MODERN MATERIALS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **10 Hrs.** | **0 Hr.** | **0 Hr.** |   Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement. | | | | | | | | | | | | |
| **Session No** | | **Topics to be covered** | **Instruction Delivery** | | | | **Testing Method** | | **Instructional objective** | | **Course Outcome** | | |
| **Method** | | **Teaching Aids** | **Level** |
| **1** | | Glass – Ceramics | Lecture with discussion,  Practical demo and practice in Industrial visit | | PPT & Videos | Apply | Tests,  Assignments | | 3. To clear description of testing of materials used for construction | | e) Make use of modern materials for economic construction. | | |
| **2** | | Sealants for joints |
| **3** | | Fibre glass reinforced plastic |
| 4 | | Clay products |
| **5** | | Refractories |
| **6** | | Composite materials – Types |
| 7 | | Applications of laminar composites |
| 8 | | Fibre textiles |  | |  |
| 9 | | Geomembranes and Geotextiles for earth reinforcement. |
| **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 | Building Materials | Varghese.P.C | PHI Learning Pvt. Ltd, New Delhi, 2012. |
| T2 | Engineering Materials | Rajput. R | K S. Chand and Company Ltd., 2008. |
| **REFERENCES** | | | |
| R1 | Alternative Building Materials Technology | Jagadish.K.S | New Age International, 2007. |
| R2 | Building Materials | Duggal.S.K | New Age International , 2008. |
| R3 | Concrete Technology, 3 Edition, | Gambhir.M.L | Tata McGraw Hill Education, 2004 |
| R4 | Concrete Technology (Theory and Practice) | Shetty.M.S | S. Chand and Company Ltd.,2008. |
| R5 | Building Materials, products, properties and systems", | Gambhir. M.L.,  Neha Jamwal | Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012. |
| **REFERENCE WEBSITES** | | | |
| 1 | <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Manuf%20Proc%20II/> | | |
| 3 | <http://www.me.iitb.ac.in/~ramesh/ME338/non_trad.pdf> | | |
| 4 | wings.buffalo.edu/...notes/class29\_nontraditional%20machining.ppt | | |

**GAP ANALYSIS:**

To satisfy the Course Objective number

1 (To state the advanced materials used in recent construction practices)

&

Course Outcome number

(1) (To state the advanced materials used in recent construction practices)

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

**CONTENT BEYOND SYLLUBI:**

Assignments forthe following topics:

1. Properties, advantage and disadvantage of steel fiber
2. Different type of admixture to improve the strength of concrete.

**COURSE INCHARGE**

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

**Programme Educational Objectives (PEOs):**

I. To prepare students for successful careers in industry or to pursue an advanced degree if so desired.

II. To develop the ability among students to synthesize data and technical concepts for application to product design.

III. To provide opportunity for students to work as part of teams on multidisciplinary projects.

IV. To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems.

V. To promote student awareness of the life-long learning and to introduce them to professional ethics and codes of professional practice.

**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: Design and conduct experiments, interpret and **analyze** the data and report results

PSO2: Identify, **formulate and solve** mechanical engineering problems.

PSO3: Understand of their professional and ethical responsibilities.

PSO4: Communicate effectively in both verbal and written forms.

**Mapping Table: COs of ME6004: Unconventional Machining Processes 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 | 1 |  |  |  |  |  |  |  |  |  |
| CO2 | 2 | 2 | 1 |  |  |  |  |  |  |  |  |  |
| CO3 | 3 | 2 | 2 | 1 |  |  |  |  |  |  |  |  |
| CO4 | 3 | 2 | 2 | 1 |  |  |  |  |  |  |  |  |
| CO5 | 3 | 3 | 3 | 2 |  |  |  |  |  |  |  |  |

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| Course Outcomes (COs) | Program Specific Outcomes (PSOs) | | | |
| PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 1 | 1 | 3 | 3 |
| CO2 | 1 | 1 | 3 | 3 |
| CO3 | 1 | 1 | 3 | 3 |
| CO4 | 1 | 1 | 3 | 3 |
| CO5 | 2 | 2 | 3 | 3 |

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