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

**DEPARTMENT OF CIVIL ENGINEERING**

**COURSE PLAN**

**COURSE CODE : CE6502 COURSE NAME : FOUNDATION ENGINEERING**

**SEMESTER : VSEM.CIVIL “A”“B” ACADEMIC YEAR: 2016-2017**

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

**FACULTY DETAILS: Mr. M.ANBARASAN, Asst. Prof/Civil Engineering**

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| **PURPOSE** | To impart Knowledge about foundation engineering |
| **PREREQUISITE** | Soil Mechanics, Basics of Hydraulics and Mechanical properties |
| **INSTRUCTIONAL OBJECTIVES** | 1. To impart ability to assess the soil condition at a given location  2. To design various types of foundations.  3. To develop an understanding of the stability of the foundation structures. |
| **INSTRUCTIONAL OUTCOME** | After completion of this course, students can able to   1. Illustrate the suitable techniques used for sub soil exploration. 2. Explain the type of foundation required for the given soil condition. 3. Select the dimensions of the foundation for various types of footing. 4. Interpret the load carrying capacity of piles. 5. Explain the stability analysis of retaining walls. |

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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 | FOUNDATION | | | | METHOD OF FOUNDATION | PRESSURE &SETTELEMENT ANALYSIS | FOUNDATION DESIGN |
|  | |  | | |  | **X** |
| 3 | Course co-coordinator | | | | | | Mr.M.ANBARASAN | |

**Direct assessment details**

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| **Name of assessment** | **Internal Marks** | **Topics** | **Duration** |
| Unit Test | 20 | Unit I | 2periods |
| 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 | 3Hrs |
| 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 : SITE INVESTIGATION AND SELECTION OF FOUNDATION**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **09Hrs.** | **0Hr** | **0 Hr** |   Scope and objectives – Methods of exploration-auguring and boring – Water boring and rotator drilling – Depth of boring – Spacing of bore hole - Sampling – Representative and undisturbed sampling – sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Bore log report – Penetration tests (SPT and SCPT) – Data interpretation (Strength parameters and Liquefaction potential) – Selection of foundation based on soil condition | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Methods of exploration | Lecture with discussion | PPT & Videos | Understand | Tests, Assignments | To impart ability to assess the soil condition at a given location | CO1:Upon completion of this course, the student will be able to illustrate the suitable techniques used for sub soil exploration. |
| **2** | Auguring |
| **3** | Water boring and rotator drilling. |
| **4** | Depth of boring |
| **5** | Sampling |
| **6** | sampling techniques |
| **7** | Split spoon sampler, Thin tube sampler, Stationary piston sampler |
| **8** | Penetration tests (SPT and SCPT) |
| **9** | Selection of foundation based on soil condition. |
| **CUMULATIVE HOURS = LECTURE - 09, TUTORIAL - 0** | | | | | | | |

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| **UNIT II:SHALLOW FOUNDATION**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Introduction – Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi‟s formula and BIS formula – factors affecting bearing capacity – problems – Bearing capacity from in-situ tests (SPT, SCPT and plate load)Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements. | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Introduction | Lecture with discussion | PPT & Videos | Understand | Tests,  Assignments | To design various types of foundations. | CO2:Upon completion of this course, the student will be able to explain the type of foundation required for the given soil condition. |
| **2** | bearing capacity of shallow foundation |
| **3** | Terzaghi’s formula and BIS formula |
| **4** | factors affecting bearing capacity |
| **5** | Bearing Capacity from insitu tests |
| **6** | Allowable bearing pressure, |
| **7** | Determination of settlement |
| **8** | Methods of minimizing settlement |
| 9 | problems |
| **CUMULATIVE HOURS = LECTURE - 18, TUTORIAL – 0** | | | | | | | |

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| **UNIT III:FOOTINGS AND RAFTS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **9 Hrs.** | **0 Hr.** | **0 Hr.** |   Air transport characteristics-airport classification-air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Case studies, Parking and circulation area. | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Types of foundation | Lecture with discussion | PPT & Videos | Understand | Tests,  Assignments | To design various types of foundations. | CO3:Upon completion of this course, the student will be able to select the dimensions of the foundation for various types of footing. |
| **2** | Contact pressure distribution below footings and raft |
| **3,4** | Isolated footings |
| **5,6** | combined footings |
| **7** | Mat foundation |
| **8** | floating foundation |
| **9** | Problems |
| **CUMULATIVE HOURS = LECTURE - 27, TUTORIAL – 0** | | | | | | | |

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| **UNIT IV:PILES**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **09 Hrs.** | **0 Hr.** | **0 Hr.** |   Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley’s) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity – Group capacity by different methods (Feld’s rule, Converse Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test – Forces on pile caps – under reamed piles – Capacity under compression and uplift | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Types of piles and their function | Lecture with discussion | PPT & Videos | Understand | Tests,  Assignments | To design various types of foundations. | CO4: Upon completion of this course, the student will be able to interpret the load carrying capacity of piles. |
| **2** | Carrying capacity of single |
| **3** | Static formula - dynamic formulae |
| 4 | Capacity from insitu tests |
| 5 | Negative skin friction |
| **6** | Group capacity by different methods |
| **7** | Settlement of pile groups |
| 8 | Interpretation of pile load test |
| 9 | under reamed piles |
| **CUMULATIVE HOURS = LECTURE - 36, TUTORIAL – 0** | | | | | | | |

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| **UNIT V:RETAINING WALLS**   |  |  |  | | --- | --- | --- | | **LECTURE** | **TUTORIAL** | **PRACTICAL** | | **09 Hrs.** | **0 Hr.** | **0 Hr.** |   Plastic equilibrium in soils – active and passive states – Rankine‟s theory – cohesionless and cohesive soil – Coulomb‟s wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls. | | | | | | | |
| **Session No** | **Topics to be covered** | **Instruction Delivery** | | | **Testing Method** | **Instructional objective** | **Course Outcome** |
| **Method** | **Teaching Aids** | **Level** |
| **1** | Slope failure Plastic equilibrium | Lecture with discussion | PPT & Videos | Understand | Tests,  Assignments | .To develop an understanding of the stability of the foundation structures. | CO5: Upon completion of this course, the student will be able to explain the stability analysis of retaining walls. |
| **2** | Rankine’s theory – cohesionless soil |
| **3** | Rankine’s theory – cohesive soil |
| 4 | Coloumb wedge theory |
| 5 | Critical failure plane |
| **6** | Graphical methods |
| **7** | pressure on the wall due to line load |
| 8 | Stability of retaining walls |
| 9 | problems |
| **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 | Soil Mechanics and Foundation Engineering | Murthy, V.N.S., | CBS Publishers and Distributers Ltd., New Delhi, 2007 |
| T2 | Basic and Applied soil mechanics | GopalRanjan and Rao A.S.R. | New Age International Pvt. Ltd, New Delhi, 2005. |
| T3 | Soil Mechanics and Foundation Engineering | Purushothama Raj. P | Pearson Education, 2013 |
| T4 | Foundation Engineering | Varghese, P.C., | Prentice Hall of India Private Limited, New Delhi, 2005 |
| **REFERENCES** | | | |
| R1 | Principles of Foundation Engineering” | Das, B.M. | Thompson Asia Pvt. Ltd., Singapore, 2003. |
| R2 | Design aids in Soil Mechanics and Foundation Engineering | Kaniraj, S.R. | Tata McGraw Hill Publishing company Ltd., New Delhi, 2002 |
| R3 | "Soil Mechanics and Foundations | Punmia, B.C. | Laxmi Publications Pvt.Ltd., New Delhi, 2005 |
| R4 | Geotechnical Engineering | Venkatramaiah, C. | New Age International Publishers, New Delhi, 2007 (Reprint) |
| R5 | Soil Mechanics and Foundation Engineering | Arora K.R. | Standard Publishers and Distributors, New Delhi, 2005. |
| R6 | IS 6403 : 1981 (Reaffirmed 1997)Breaking capacity of shallow foundation | Indian Standards Institution | Bureau of Indian Standards, New Delhi, 1998 |
| R7 | IS8009 (Part1):1976 (Reaffirmed 1998) “Shallow foundations subjected to symmetrical static vertical loads | Indian Standards Institution | Bureau of Indian Standards, New Delhi, 1999 |
| R8 | IS8009 (Part2):1980 (Reaffirmed 1995) “Deep foundations subjected to symmetrical static vertical loading | Indian Standards Institution | Bureau of Indian Standards, New Delhi, 1992 |
| R9 | IS2911(Part1):1979 (Reaffirmed 1997) “Concrete Piles” | Indian Standards Institution | Bureau of Indian Standards, New Delhi, 1994 |
| R10 | IS2911(Part 3) :1979 (Reaffirmed 1997) “Under Reamed Piles | Indian Standards Institution | Bureau of Indian Standards, New Delhi, 1998 |
| **REFERENCE WEBSITES** | | | |
| 1 | www.wikipedia.com | | |
| 2 | www.NPTEL.com | | |

**GAP ANALYSIS:**

To satisfy the

1. Course Outcome number (2) (Explain the type of foundation required for the given soil condition.)

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Content beyond syllabi to be exposed to the student through the extra lecture hour

**CONTENT BEYOND SYLLUBI:**

1. Foundations for Industrial Machines and Earthquake Effects.

**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.

**ProgrammeOutcomes (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**

1. 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.

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

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

**Mapping Table: COs of CE6502:Foundation Engineering 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 |
| CO LEVEL | K3 | K4 | K5 | K5 |  |  |  |  |  |  |  |  |
| CO1 | K2 | 2 | 1 | - | - |  |  |  |  |  |  |  |  |
| CO2 | K2 | 2 | 1 | - | - |  |  |  |  |  |  |  |  |
| CO3 | K3 | 3 | 2 | 1 | - |  |  |  |  |  |  |  |  |
| CO4 | K2 | 2 | 1 | - | - |  |  |  |  |  |  |  |  |
| CO5 | K2 | 2 | 1 | - | - |  |  |  |  |  |  |  |  |

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| Course Outcomes (COs) |  | PSO1 | PSO2 | PSO3 |
| CO LEVEL | K3 | K4 | K4 |
| CO1 | K2 | 2 | - | - |
| CO2 | K2 | 2 | - | - |
| CO3 | K3 | 3 | - | - |
| CO4 | K2 | 2 | - | - |
| CO5 | K2 | 2 | - | - |

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