# COURSE STRUCTURE & SYLLABUS

For

# B.Tech.

## CIVIL ENGINEERING

(*Applicable for batches admitted from 2019-20*)

# PRAGATI ENGINEERING COLLEGE

**(AUTONOMOUS)**

Permanently Affiliated to JNTUK, Kakinada, Accredited by NAAC with "A" Grade
Recognized by UGC 2(f) and 12(b) under UGC act, 1956
# 1-378, ADB Road, Surampalem – 533 437
Near Peddapuram, E.G.Dist, Andhra Pradesh

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

**Zero Semester:**

| Induction Programming (Mandatory) | 3 weeks duration |
|---|---|
| Induction program for students to be offered at the start of the first year. | 1. Physical activity<br>2. Creative arts<br>3. Universal human values<br>4. Literary<br>5. Proficiency modules<br>6. Lectures by eminent peoples<br>7. Visit local areas<br>8. Familiarization of dept./branch and innovation |

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of large purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3 week long induction program for U G students entering the institution, right at start. Normal classes start only after induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large and nature. The time during the induction program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under induction program in which the student would be fully engaged throughout the day for entire duration of induction program.

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**I Year – I Semester**

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Humanities, Social Science including Management Studies | 19HE1T01 | Professional Communicative English | 3 | -- | -- | 3 |
| 2 | Basic Sciences | 19BM1T01 | Linear Algebra and Differential Equations | 3 | -- | -- | 3 |
| 3 | Basic Sciences | 19BC1T01 | Engineering Chemistry | 3 | -- | -- | 3 |
| 4 | Engineering Sciences | 19CS1T01 | Programming for Problem Solving using C | 3 | -- | -- | 3 |
| 5 | Engineering Sciences | 19ME1T02 | Engineering Mechanics | 3 | -- | -- | 3 |
| 6 | Humanities, Social Science including Management Studies | 19HE1L01 | Professional Communicative English Laboratory - I | -- | -- | 3 | 1.5 |
| 7 | Engineering Sciences | 19CS1L01 | Programming for Problem Solving using C Laboratory | -- | -- | 3 | 1.5 |
| 8 | Basic Sciences | 19BC1L01 | Engineering Chemistry Laboratory | -- | -- | 3 | 1.5 |
| 9 | Mandatory Courses | 19BE1T01 | Environmental Science | 2 | -- | -- | 0 |
| **Total Credits** | | | | | | | **19.5** |

**I Year – II Semester**

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Basic Sciences | 19BM2T02 | Numerical Methods & Multivariable Calculus | 3 | -- | -- | 3 |
| 2 | Basic Sciences | 19BM2T03 | Integral Transforms and Vector Calculus | 3 | -- | -- | 3 |
| 3 | Basic Sciences | 19BP2T01 | Engineering Physics | 3 | -- | - | 3 |
| 4 | Professional Core | 19CE2T01 | Construction Materials | 3 | -- | -- | 3 |
| 5 | Professional Core | 19CE3T05 | Geodesy | 3 | -- | -- | 3 |
| 6 | Engineering Sciences | 19ME2T01 | Engineering Drawing | 1 | -- | 3 | 2.5 |
| 7 | Engineering Sciences | 19ME2L01 | Engineering Workshop & IT Workshop | -- | -- | 3 | 1.5 |
| 8 | Basic Sciences | 19BP2L01 | Engineering Physics Laboratory | -- | -- | 3 | 1.5 |
| 9 | Humanities, Social Science including Management Studies | 19HM2T05 | Constitution of India | 2 | -- | -- | 0 |
| **Total Credits** | | | | | | | **20.5** |

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## II Year – I Semester

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Engineering Sciences | 19EE3T02 | Basic Electrical and Electronics Engineering | 3 | -- | -- | 3 |
| 2 | Basic Sciences | 19BM3T04 | Probability and Statistics | 3 | -- | -- | 3 |
| 3 | Professional Core | 19CE3T02 | Building Planning & Drawing | 1 | -- | 4 | 3 |
| 4 | Professional Core | 19CE3T03 | Fluid Mechanics | 3 | -- | -- | 3 |
| 5 | Professional Core | 19CE3T04 | Strength of Materials-I | 3 | -- | -- | 3 |
| 6 | Professional Core | 19CE3L01 | Strength of Materials Laboratory | -- | -- | 3 | 1.5 |
| 7 | Professional Core | 19CE3L02 | Geodesy Laboratory-I | -- | -- | 3 | 1.5 |
| 8 | Project Work | 19CE3P01 | Socially Relevant Activity* | -- | -- | -- | 0.5 |
| 9 | Humanities, Social Science including Management Studies | 19HM3T07 | Professional Ethics & Human Values | 2 | -- | -- | 0 |
| **Total Credits** | | | | | | | **18.5** |

*** 15hours per semester**

## II Year – II Semester

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Professional Core | 19CE4T06 | Strength of Materials-II | 3 | -- | - | 3 |
| 2 | Professional Core | 19CE4T07 | Concrete Technology | 3 | -- | -- | 3 |
| 3 | Professional Core | 19CE4T08 | Engineering Geology | 3 | -- | -- | 3 |
| 4 | Professional Core | 19CE4T09 | Hydraulics & Hydraulic Machinery | 3 | -- | -- | 3 |
| 5 | Professional Core | 19CE4T10 | Highway Engineering | 3 | -- | -- | 3 |
| 6 | Professional Core | 19CE4T11 | Structural Analysis –I | 3 | -- | -- | 3 |
| 7 | Professional Core | 19CE4L03 | Fluid Mechanics & Hydraulic Machinery Laboratory | -- | -- | 3 | 1.5 |
| 8 | Professional Core | 19CE4L04 | Engineering Geology Laboratory | -- | -- | 3 | 1.5 |
| 9 | Humanities, Social Science including | 19HE2L02 | Professional Communicative English Laboratory – II | -- | -- | 3 | 1.5 |
| 10 | Humanities, Social Science including Management Studies | 19HM4T06 | Essence of Indian Traditional Knowledge | 2 | -- | -- | 0 |
| **Total Credits** | | | | | | | **22.5** |

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### III Year – I Semester

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Humanities, Social Science including Management Studies | 19HM5T01 | Managerial Economics and Financial Analysis | 3 | -- | -- | 3 |
| 2 | Professional Core | 19CE5T12 | Estimation, Specifications and Contracts | 3 | -- | -- | 3 |
| 3 | Professional Core | 19CE5T13 | Design & Detailing of Reinforced Concrete | 3 | -- | -- | 3 |
| 4 | Professional Core | 19CE5T14 | Geotechnical Engineering-I | 3 | -- | -- | 3 |
| 5 | Professional Core | 19CE5T15 | Structural Analysis – II | 3 | -- | -- | 3 |
| 6 | Professional Core | 19CE5T16 | Railways, Airports and Seaports | 3 | -- | -- | 3 |
| 7 | Professional Core | 19CE5L05 | Geotechnical Engineering Laboratory | -- | -- | 3 | 1.5 |
| 8 | Professional Core | 19CE5L06 | Concrete Technology Laboratory | -- | -- | 3 | 1.5 |
| 9 | Professional Core | 19CE5L07 | Geodesy Laboratory-II | -- | -- | 3 | 1.5 |
| 10 | Mandatory Course | 19CE5T17 | MOOCs** | -- | -- | -- | 0 |
| 11 | Humanities, Social Science including Management Studies | 19HM5T08 | IPR & Patents | 2 | -- | -- | 0 |
| **Total Credits** | | | | | | | **22.5** |

****Student can select the course of any discipline under MOOCs. However, the agency will be decided by the respective BOS.

### III Year – II Semester

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Professional Core | 19CE6T19 | Water Supply & Waste Water Engineering | 3 | -- | -- | 3 |
| 2 | Professional Core | 19CE6T20 | Geotechnical Engineering-II | 3 | -- | -- | 3 |
| 3 | Professional Core | 19CE6T21 | Design & Detailing of Steel Structures | 3 | -- | -- | 3 |
| 4 | Professional Core | 19CE6T22 | Water Resource Engineering -I | 3 | -- | -- | 3 |
| 5 | Open Elective | | **Open Elective-I:** | 3 | -- | -- | 3 |
| 6 | Professional Core | 19CE6L08 | Environmental Engineering Laboratory | -- | -- | 3 | 1.5 |
| 7 | Professional Core | 19CE6L09 | Transportation Engineering Laboratory | -- | -- | 3 | 1.5 |
| 8 | Professional Core | 19CE6L10 | Computer Aided Engineering Drawing | -- | -- | 3 | 1.5 |
| 9 | Project Work | 19CE6P02 | Mini Project | -- | -- | 2 | 1 |
| **Total Credits** | | | | | | | **20.5** |

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**IV Year – I Semester**

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Professional Core | 19CE7T25 | Foundation Engineering | 3 | -- | -- | 3 |
| 2 | Professional Core | 19CE7T26 | Water Resource Engineering-II | 3 | -- | -- | 3 |
| 3 | Open Elective | | **Open Elective-II** | 3 | -- | -- | 3 |
| 4 | Professional Elective | | **Professional Elective –I** | 3 | -- | -- | 3 |
| 5 | Professional Elective | | **Professional Elective –II** | 3 | -- | -- | 3 |
| 6 | Professional Core | 19CE7L11 | Irrigation Drawing Laboratory | -- | -- | 3 | 1.5 |
| 7 | Professional Core | 19CE7L12 | GIS & STAAD Pro Laboratory | -- | -- | 3 | 1.5 |
| **Total Credits** | | | | | | | **18** |

**IV Year – II Semester**

| S. No. | Course Category | Subject Code | Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | Professional Core | 19CE8T39 | Construction Technology & Management | 3 | -- | -- | 3 |
| 2 | Professional Core | 19CE8T40 | Pre-Stressed Concrete | 3 | -- | -- | 3 |
| 3 | Professional Elective | | **Professional Elective – III** | 3 | -- | -- | 3 |
| 4 | Project Work | 19CE8P03 | Project Work | -- | -- | 18 | 9 |
| **Total Credits** | | | | | | | **18** |

**Total course Credits: 40 + 41 + 43 + 36 = 160**

| S No | Code | Open Elective-I |
|---|---|---|
| 1 | 19HM6T03 | Entrepreneurship |
| 2 | 19BP6T03 | Nuclear Science & Technology |
| 3 | 19EE6T36 | Power Safety & Management |
| 4 | 19ME6T22 | Industrial Engineering & Management |
| 5 | 19EC6T39 | Electronic Measurements & Instrumentation |
| 6 | 19CS6T05 | Object oriented Programming through Java |

| S No | Code | Open Elective-II |
|---|---|---|
| 1 | 19HM7T02 | Management Science |
| 2 | 19BC7T03 | Material Chemistry & Engineering Applications |
| 3 | 19EE7T24 | Energy Audit, Conservation & Management |
| 4 | 19ME7T47 | Non Destructive Evaluation |
| 5 | 19EC7T10 | Internet of Things |
| 6 | 19CS7T03 | Python Programming |

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| S No | Code | Professional Elective-I |
|---|---|---|
| 1 | 19CE7T27 | Ground Improvement Techniques |
| 2 | 19CE7T28 | Repair & Maintenance of Structures |
| 3 | 19CE7T29 | Transportation Planning Engineering |
| 4 | 19CE7T30 | Industrial Waste Management |
| 5 | 19CE7T31 | Urban Hydrology |
| 6 | 19CE7T32 | Air Pollution & Control |

| S No | Code | Professional Elective-II |
|---|---|---|
| 1 | 19CE7T33 | Advanced Foundation Engineering |
| 2 | 19CE7T34 | Advanced Structural Engineering |
| 3 | 19CE7T35 | Pavement Analysis & Design |
| 4 | 19CE7T36 | Municipal Solid Waste Management |
| 5 | 19CE7T37 | Ground Water Development |
| 6 | 19CE7T38 | Remote Sensing & GIS Applications |

| S No | Code | Professional Elective-III |
|---|---|---|
| 1 | 19CE8T41 | Soil Dynamics & Machine Foundation |
| 2 | 19CE8T42 | Bridge Engineering |
| 3 | 19CE8T43 | Traffic Engineering |
| 4 | 19CE8T44 | Earthquake Engineering |
| 5 | 19CE8T45 | Water Resource System Planning |
| 6 | 19CE8T18 | Environmental Impact Assessment & Management |

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# I B.Tech. - I Semester

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**Subject Code: 19HE1T01**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

# PROFESSIONAL COMMUNICATIVE ENGLISH

**Introduction:**
In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering.

As far as the detailed Textbooks are concerned, the focus is on the skills of listening, speaking, reading and writing. The non-detailed Textbooks are meant for extensive reading for pleasure and profit. Thus the stress in the syllabus is primarily on the development of communicative skills and fostering ideas.

**Objectives:**

1. To improve the language proficiency of the learners in English with emphasis on LSRW skills.
2. To enable the learners to study and comprehend the prescribed course effectively relating to their theoretical and practical components.
3. To develop the communication skills of the learners in both formal and informal situations.

## LISTENING SKILLS

Objectives:

1. To enable the learners to appreciate the role of listening skill and improve their pronunciation.
2. To enable the learners to comprehend the speech prescribe of people belonging to different backgrounds and regions.
3. To enable the learners to listen for general content, to fill up information and infer the content.

## SPEAKING SKILLS

Objectives:

1. To make the learners aware of the importance of speaking for their personal and professional communication.
2. To enable the learners to express themselves fluently and accurately in social and professional set up.
3. To help the learners describe objects, situations and people.
4. To make the learners participate in group activities like role-plays, discussions and debates.
5. To make the learners participate in Just a Minute talks.

## READING SKILLS

Objectives:

1. To enable the learners to comprehend a text through silent reading.
2. To enable the learners to guess the meanings of words, messages and inferences of texts in given contexts.

3. To enable the learners to skim and scan a text.
4. To enable the learners to identify the topic sentence.
5. To enable the learners to identify discourse features.
6. To enable the learners to make intensive and extensive reading.

## WRITING SKILLS

Objectives:

1. To make the learners understand that writing is an exact formal skill.
2. To enable the learners to write sentences and paragraphs coherently and cohesively.
3. To make the learners identify and use appropriate vocabulary.
4. To enable the learners to narrate and describe.
5. To enable the learners capable of note-making.
6. To make the learners to write formal and informal letters.
7. To enable the learners to describe graphs using expressions of comparison.
8. To enable the learners to write technical reports.

**Methodology:**

1. The classes are to be learning-centred where the learners participate in the language learning activities with the peer group and the facilitator.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be animated with the help of learning positive activities such as pair work, Group Discussion and so on.
4. The facilitator is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The facilitator activities the learning in a particular mode.

The following text books are recommended for study in I B.Tech I Semester (Common for all branches) of Pragati Engineering College, Surampalem from the academic year 2019-20 (R-19 Regulations)

**DETAILED TEXTBOOK:**

- **PROFESSIONAL COMMUNICATIVE ENGLISH** *Published by Maruthi Publishers.*

**NON-DETAILED TEXTBOOK:**

- *-PANORAMA: A COURSE ON READING, Published by Oxford University Press India*
  The course content along with the study material is divided into six units.

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# Linear Algebra and Differential Equations

**(Common to CE, EEE, ME, ECE, CSE & IT)**

**I B. Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 19BM1T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Basics of matrices,<br>Differentiation, Integration | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | solve systems of linear equations, determine the rank, find the eigenvalues and eigenvectors, diagonalization of a matrix. | K3 |
| **CO2** | identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics. | K2 |
| **CO3** | solve first order differential equations and its applications | K3 |
| **CO4** | solve the linear differential equations with constant coefficients by appropriate method | K3 |
| **CO5** | find partial derivatives of multivariable functions and apply them to find extreme values of a function. | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |

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| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Solving system of linear equations, Eigen Values and Eigen vectors**<br>Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method for solving system of equations – Eigenvalues and Eigen vectors and their properties. |
| **UNIT II** | **Cayley-Hamilton Theorem and Quadratic forms**<br>Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Reduction to diagonal form-Quadratic forms-nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation. |
| **UNIT III** | **Differential equations of first order and first degree**<br>Linear – Bernoulli – Exact – Reducible to exact.<br>**Applications:** Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories. |
| **UNIT IV** | **Linear differential equations of higher order**<br>Non-homogeneous equations of higher order with constant coefficients with RHS term of the type $e^{ax}$, $\sin ax$, $\cos ax$, polynomials in $x^n$, $e^{ax}V(x)$, $x^mV(x)$ - Method of Variation of parameters. |
| **UNIT V** | **Partial differentiation**<br>Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor's and Maclaurin's series expansion of functions of two variables – Jacobian – Functional dependence.<br>**Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints). |

| **TEXT BOOKS** | |
|---|---|
| **1.** | **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. |
| **2.** | **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India |
| **REFERENCE BOOKS** | |
| **1.** | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |
| **2.** | **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press |
| **3.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **4.** | **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press. |
| **5.** | **T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications. |
| **WEB RESOURCES** | |
| **1.** | **UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors**<br>https://en.wikipedia.org/wiki/System_of_linear_equations<br>https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors |

| | |
|---|---|
| | |
| **2.** | **UNIT II: Cayley-Hamilton Theorem and Quadratic forms**<br>https://www.math.hmc.edu/calculus/tutorials/eigenstuff/<br>https://en.wikipedia.org/wiki/Quadratic_form |
| **3.** | **UNIT III: Differential equations of first order and first degree**<br>https://en.wikipedia.org/wiki/Differential_equation<br>http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode<br>https://www.khanacademy.org/math/differential-equations/first-order-differential-equations |
| **4.** | **UNIT IV: Linear differential equations of higher order**<br>https://en.wikipedia.org/wiki/Differential_equation<br>http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode<br>https://nptel.ac.in/courses/122107037/20 |
| **5.** | **UNIT V: Partial Differentiation**<br>https://en.wikipedia.org/wiki/Partial_derivative<br>https://www.whitman.edu/mathematics/calculus_online/section14.03.html |

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## ENGINEERING CHEMISTRY

**(Civil Engineering)**

| **Course Category** | Basic Sciences | **Course Code** | 19BC1BS01 |
|---|---|---|---|
| Course Type | Theory | L-T-P-C | 3-0-3-4.5 |
| Prerequisites | Intermediate Chemsitry | Internal Assessment<br>Semester End Examination<br>Total Marks | 40<br>60<br>100 |

**COURSE OBJECTIVES**

| | |
|---|---|
| **1** | To learn about the hardness of water, boiler troubles, Drinking water standards and methods of removal of hardness of water |
| **2** | To get knowledge on Electrochemical cells, Batteries and fuel cells and their applications |
| **3** | To study about the factors affecting corrosion, controlling methods and about organic coatings |
| **4** | To learn about Cement, its setting and hardness, methods of polymerization, Plastics and Elastomers |
| **5** | To study about Nano materials, their preparation and applications and to gain awareness on smart materials, |

**COURSE OUTCOMES**

**Upon successful completion of the course, the student will be able to:**

| | |
|---|---|
| **CO1** | Distinguish between temporary and permanent hardness of water. |
| **CO2** | Illustrate the principles and applications of Batteries and Fuel cells |
| **CO3** | Identify different types of corrosion and their controlling methods. |
| **CO4** | Illustrate the principles of setting and hardening of cement and explain about polymers and their engineering applications. |
| **CO5** | Analyze the importance of nano and smart materials and Illustrate the principle of BET & TEM. |

**Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | **2** | **1** | **2** | | **3** | **3** | | | | **3** | **1** | **1** | | **1** |
| **CO2** | **2** | **1** | | | **2** | | **1** | | | | **2** | **2** | | | |
| **CO3** | **1** | | **2** | | **2** | | **1** | | | | **1** | | | **1** | |
| **CO4** | **3** | | **1** | **2** | | **1** | **1** | | | | **2** | | **1** | | |
| **CO5** | **2** | | **3** | | | **2** | **2** | | | | **1** | **1** | | | |

**COURSE CONTENT**

**UNIT I**

**WATER TECHNOLOGY** **9 hrs**

Introduction –Hard and Soft water, Estimation of hardness by EDTA Method - Boiler troubles - scale and sludge-priming and foaming and Caustic Embrittlement; Specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, Industrial water – Primary and secondary treatments, zeolite and ion-exchange processes- desalination of brackish water, reverse osmosis (RO) and electro dialysis.

| | |
|---|---|
| | **Learning outcomes:**<br>After the completion of the Unit I, the student will be able to<br>• **explain** the principles of reverse osmosis and electro dialysis. (**L-2)**<br>• **compare** the quality of drinking water with BIS and WHO standards. (**L-2)**<br>• **illustrate** boiler troubles associated with hard water. (**L-2)**<br>• **demonstrate** the Industrial water treatment processes. (**L-2)** |
| **UNIT II** | **ENERGY SOURCES AND APPLICATIONS** **9 hrs**<br>Electrode potential, determination of single electrode potential –Nernst's equation, Reference electrodes: Hydrogen and calomel electrodes – electrochemical series and its applications<br>Batteries: Primary cell- dry or Leclanche cell, Secondary cell- Nickel-Cadmium cell – lithium batteries (Lithium-$MnO_2$); Fuel cells- $H_2$-$O_2$ fuel cell<br>Solar energy: Photovoltaic cell and its applications.<br>Fuels- Classification and characteristics-Liquid fuels- Refining of petroleum; gaseous fuels-LPG and CNG applications<br>**Learning outcomes:**<br>After the completion of the Unit II, the student will be able to<br>• **define** electrode potential. (**L-1)**<br>• **derive** Nernst's equation. (**L-2)**<br>• **outline** the difference between primary and secondary cells. (**L-2)**<br>• **identify** the applications of photo voltaic cell. (**L-2)**<br>• **discuss** the applications of LPG and CNG (**L-2**) |
| **UNIT III** | **CORROSION ENGINEERING** **6+6 hrs**<br>**III-A: Corrosion:** Definition – theories of corrosion-Dry corrosion: Metal oxide formation - pilling bed worth ratio; Electro chemical corrosion: Mechanism, Factors affecting corrosion (nature of the metal and nature of the environment).<br>**III-B: Corrosion controlling methods:** Sacrificial and Impressed current cathodic protection.<br>Metallic coatings – Galvanizing and Tinning- Electro plating and Electro less plating; Anodic inhibitors and Cathodic inhibitors.<br>Organic coatings – Paints and Varnishes (constituents and their functions).<br>**Learning outcomes:**<br>After the completion of the Unit III, the student will be able to<br>• **explain** theories of corrosion. (**L-2)**<br>• **identify** the various factors affecting corrosion. (**L-3)**<br>• **classify** different inhibitors of corrosion (**L-2**)<br>• **choose** different organic coatings. (**L-3)**<br>• **apply** the principles of corrosion control. **(L-3)** |
| **UNIT IV** | **ENGINEERING MATERIALS AND POLYMERS** **10 hrs**<br>**Cement:** Portland cement, constituents, Manufacture of Portland Cement, Chemistry of setting and hardening of Cement (hydration, hydrolysis, equations).<br>**Refectories-**Classification, properties(refractoriness, refractoriness under load, porosity)<br>**Polymers**: Introduction-Methods of Polymerization (Emulsion and Suspension), Conducting polymers – Mechanism of conduction in poly acetylene – applications, Bio – degradable polymers.<br>**Plastics**: Thermoplastics and thermo setting resins; Moulding of plastics – Compression and Injection moulding - Preparation, properties and applications of Polystyrene and Bakelite.<br>**Elastomers**: Natural Rubber, Vulcanization of rubber; Synthetic Rubbers -Preparation, properties and applications of Buna-S and Thiokol.<br>**Learning outcomes:**<br>After the completion of the Unit IV, the student will be able to<br>• **illustrate** the chemical reactions involved in the manufacturing of cement and properties of refractories. (**L-2)**<br>• **identify** preparation and properties of different polymers. **(L-3)**<br>• **distinguish** between thermoplastic and thermo setting resins. (**L-4)**<br>• **identify** applications of conducting polymers **(L-3)** |

| | |
|---|---|
| **UNIT V** | **NANO AND SMART MATERIALS** **8 hrs**<br>**Nano Materials:** Introduction to Nano materials, Preparation of Carbon Nano Tubes(CNTs) by Laser Ablation and Chemical Vapor Deposition Methods, Fullerenes -Preparation, Properties and Applications; Chemical synthesis of nano materials : Sol-gel method, Characterization of nano mateirals by BET & TEM (basic principles), Applications of nano materials in waste water treatment, lubricants, Medicine and sensors.<br>**Smart Materials:** Introduction – Types of smart materials-Self healing materials, Shape memory alloys and uses of smart materials.<br>**Learning outcomes:**<br>After the completion of the Unit V, the student will be able to<br>• **classify** nano materials. (**L-2)**<br>• **explain** the synthesis and characterization methods of nano materials. (**L-2)**<br>• **explain** principles of BET & TEM. **(L-4)**<br>• **identify** different types of smart materials. (**L-2)** |


| **TEXT BOOKS** | |
|---|---|
| **1.** | P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014). |
| 2. | Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition . |
| **REFERENCE BOOKS** | |
| 1. | Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003) |
| 2. | S.S. Dara, A Textbook of Engineering Chemistry, S.Chand & Co, (2010) |
| 3. | N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014) |
| **WEB RESOURCES** | |
| 1. | Water Technology<br>1.https://www.scribd.com/document/.../Engineering-Chemistry-Unit-I-Water-Treatment<br>2.www.lenntech.com/applications/process/boiler/boiler-water-treatment.htm |
| 2. | Energy Sources and Applications<br>https://en.wikipedia.org/wiki/Electrochemical_cell |
| 3. | Corrosion Engineering &Corrosion controlling methods<br>https://en.wikipedia.org/wiki/Corrosion |
| 4. | Engineering Materials and Polymers<br>https://en.wikipedia.org/wiki/Polymer_chemistry |
| 5. | Nano and Smart Materials<br>https://en.wikipedia.org/wiki/Nanomaterials |

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## Programming for Problem solving using C

**(Common to CE, ME, EEE, ECE, CSE, IT)**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Science | **Course Code** | 19CS1T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To impart adequate knowledge on the need of programming languages and problem solving techniques. |
| **2** | To develop programming skills using the fundamentals of C Language. |
| **3** | To enable effective usage of arrays, structures, functions, pointers and dynamic memory allocation. |
| **4** | To make use of file handling functions in programming. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Apply the fundamentals of C Programming for Problem solving. | L3 |
| **CO2** | Identify the appropriate Decision statement and Loops for a given Problem. | L2 |
| **CO3** | Make use of Arrays and Strings to solve the problems in C. | L3 |
| **CO4** | Apply the concepts of Functions and Pointers in Problem solving. | L3 |
| **CO5** | Develop solutions for problems using Structures, Unions and Files. | L3 |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| **CO2** | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| **CO3** | 3 | 3 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| **CO4** | 2 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |

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| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Introduction to Programming**–Introduction to Computer Software, Classification of Computer Software, Representation of Data – Bits and Bytes, Programming Languages – High and Low Level Languages, Generation of Programming Languages, Program Design Tools: Algorithms, Flowcharts, Pseudocode, Types of Errors, Testing & Debugging Approaches.<br>**Introduction to C –** Structure of a C Program, Writing the First C Program, Header Files used in C Program, Compiling and Executing C Programs. |
| **UNIT II** | **Tokens in C:** Basic Data Types in C – Keywords, Identifiers, Variables, Constants, Input / Output statements in C, Operators in C, Precedence and Associativity Rules, Type Casting Types.<br>**Decision Control**: Decision Control Statements: Conditional Branching Statements - if, if – else, nested if, if – else – if, and Switch – Case.<br>**Basic Loop Structures**: Iterative Statements - for, while and do - while, Nested Loops, The 'Break', 'Continue', and 'goto' statements. |
| **UNIT III** | **Arrays:** Declaration and Initialization of Arrays, Accessing & Storing the elements of an Array, Operations on Arrays: Traversing, Inserting, Deleting, Searching, Two Dimensional Arrays: Declaring, Initializing, Accessing, Operations on Two Dimensional Arrays (Matrices), Applications of Arrays.<br>**Strings:** String Fundamentals, String Input and Output, String Library Functions |
| **UNIT IV** | **Functions:** Function Declaration / Function Prototypes, Function Definition, Function Call (Call by Value), Passing Parameters to Functions, Return Statement, Storage Classes, Recursive Functions, Arrays as Function Arguments.<br>**Pointers**: Declaring Pointer Variables, Pointer Arithmetic, Passing Arguments to Function using Pointers (Call by Reference), Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation – Malloc, Calloc, Realloc, Free. |
| **UNIT V** | **Structures**: Introduction to Structures, Nested Structures, Array of Structures.<br>**Unions:** Introduction, Array of Union Variables, Union inside Structure, Enumerated Data Types, Bit Fields.<br>**Files**: Declaring, Opening, and Closing File, Reading from and Writing to Text Files. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Programming in C, Reema Thareja, 2nd Edition, Oxford University Press. |
| **2.** | The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education |
| **REFERENCE BOOKS** | |
| **1.** | Programming in C – Ashok N.Kamthane, Amit Ashok Kamthane, 3rd Edition, Pearson. |
| **2.** | C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage. |
| **3.** | Programming in C (A Practical Approach) – Ajay Mittal, First Edition, Pearson. |
| **WEB RESOURCES** | |
| **1.** | http://nptel.ac.in/courses/106104128/ |
| **2.** | http://students.iitk.ac.in/programmingclub/course/#notes |
| **3.** | http://c-faq.com/~scs/cclass/cclass.html |
| **4.** | http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu |
| **5.** | http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/ |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
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# ENGINEERING MECHANICS
**(Common to CE & ME)**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Science | **Course Code** | 19ME1T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Engineering Physics and Applied Mathematics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To study forces, free body diagrams & equations of equilibrium of coplanar systems and its applications. |
| **2** | To study Trusses, friction and its applications. |
| **3** | To learn about centroid and moments of Inertia of simple and composite figures. |
| **4** | To learn various paths of velocity and acceleration computation. |
| **5** | To study about work, energy and particle motion for engineering applications. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level*** |
| **CO1** | Analyze the Forces, Free Body Diagrams & Equations of Equilibrium of Coplanar Systems. | k4 |
| **CO2** | Analyze the trusses ,friction and its applications. | k4 |
| **CO3** | Evaluate the centroid and moments of Inertia of Composite Figures. | k5 |
| **CO4** | Determine the paths of velocity and acceleration computation. | k5 |
| **CO5** | Adapt the concepts of work, energy and particle motion for engineering applications. | k6 |

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5- Evaluating, k6- Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - |
| **CO2** | 3 | 3 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 2 | - |
| **CO3** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | 2 | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |

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| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Introduction to Engineering Mechanics**: Basic Concepts of mechanics, System of Forces. **Resultant System of Forces**: Resultant of Coplanar Concurrent Force System - Moment of a Force, Couple, Varignon's Theorem, Resultant of Coplanar Non-Concurrent Force System. **Equilibrium System of Forces**: Equations of Equilibrium of Coplanar Systems, Free Body Diagrams, Lami's Theorem, Equilibrium of Connected Bodies. |
| **UNIT II** | **Friction**: Introduction**,** types of friction, Coulomb's laws of dry friction, coefficient of friction, cone of friction. **Trusses**: Introduction, Assumptions and Equilibrium analysis of plane trusses by using method of joints. |
| **UNIT III** | **Centroid:** Introduction**,** Centroids of simple and composite sections. **Centre of Gravity:** Simple bodies and Composite bodies, Pappus Theorem. **Moment of Inertia:** Definition – Transfer Theorem, Perpendicular Theorem, Polar Moment of Inertia, Moment of Inertia of Simple and Composite Figures, mass moment of inertia of simple bodies. |
| **UNIT IV** | **Kinematics**: D'Alembert's Principle, Rectilinear Motion and curvilinear motion, Motion with Uniform Velocity, Motion with Uniform Acceleration. **Kinetics**: Analysis as a Particle and Analysis as a Rigid Body in Translation, Equations of Plane Motion – Fixed Axis Rotation. |
| **UNIT V** | **Work – Energy Method:** Equations for Translation, Motion of Connected Bodies Fixed Axis Rotation and Plane Motion. Impulse momentum method. |

| **TEXT BOOKS** | |
|---|---|
| **1** | Engineering Mechanics - S.Timoshenko, D.H.Young., 5th Edition - , Mc Graw Hill. |
| **2** | Engineering Mechanics - S. S. Bhavikatti, K G Rajasekharappa, Revised Edition, New Age International. |
| **REFERENCE BOOKS** | |
| **1** | Engineering Mechanics, N.H.Dubey, McGraw Hill, 2013. |
| **2** | Engineering Mechanics, A.K.Tayal, 14th edition, 2nd reprint, Umesh Publications, 2012. |
| **3** | Engineering Mechanics, R.K.Bansal, 3rd edition, Laxmi Publications, 1996. |
| **4** | Engineering Mechanics: Statics & Dynamics, A. Nelson, Tata McGraw-Hill Education, 2009. |
| **5** | Engineering Mechanics, Fedinand . L. Singer, Harper – Collins. |
| **WEB RESOURCES** | |
| **1** | http://nptel.ac.in/courses/Webcourse-contents/IITKANPUR/engg_mechanics/ui/Course_home_3.htm |

| | |
|---|---|
| **2** | http://nptel.ac.in/courses/122104015/ |
| **3** | https://nptel.ac.in/courses/122104015/ |
| **4** | https://freevideolectures.com/course/2264/engineering-mechanics |
| **5** | https://nptel.ac.in/courses/112103108/3 |
| **6** | https://nptel.ac.in/courses/115104094/54 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

**Subject Code: 19HE1L01**

**Professional Communicative English Lab – I**
**(For CE, EEE, ME, CSE & IT)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**PRESCRIBED LAB MANUAL FOR SEMESTER I:**

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills' Published by Maruthi Publications.

**Objectives:**
To enable the students to learn the communication skills; listening, speaking, reading and writing.
**Outcome:**
The course enables the learner to acquire communication skills which will help the students to become successful in the competitive world.

The course content along with the study material is divided into six units.

**UNIT 1:**
Hello, I'm ……
Consonant Sounds

**UNIT 2:**
I would love to …. But,
Vowel Sounds

**UNIT 3:**
With your Permission, I would like to
Syllable and Accent

**UNIT 4:**
Why don't we……

Pronunciation and Rhythm

**UNIT 5:**
Could you please ……

Tones

**UNIT-6:** Dialogues

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
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# Programming for Problem solving using C Laboratory

**(Common to CE, ME, EEE, ECE, CSE, IT)**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Science | **Course Code** | 19CS1L01 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn various steps in program development using Raptor. |
| **2** | To write C programs using basic concepts in C like operators, control statements etc., |
| **3** | To design modular, reusable and readable C programs using concepts like Arrays, Functions and Pointers. |
| **4** | To write programs using Structures and Unions. |
| **5.** | To write programs to perform file operations. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Translate given algorithms to a working programs. | L2 |
| **CO2** | Design programs using Pointers to access Arrays, Strings and Functions. | L3 |
| **CO3** | Develop programs using Structures, Unions and File operations. | L3 |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 |

| **COURSE CONTENT** | |
|---|---|
| **1.** | Construct flowcharts using Raptor Tool to<br>a) calculate the maximum, minimum and average of three numbers<br>b) calculate area of a triangle given three sides using Heron's formula. |

<table>
<tr><td>2.</td><td>Construct flowcharts using Raptor Tool to<br>a) calculate simple interest for various parameters specified by the user.<br>b) swapping of two numbers with and without using the third variable.</td></tr>
<tr><td>3.</td><td>Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers.</td></tr>
<tr><td>4.</td><td>Write a C Program to find the Grade of a student by taking input of percentage using all Relational Operators (>, >=, <, <=, ==, != )
<table>
<tr><th>Theory (%)</th><th>Letter Grade</th><th>Level</th></tr>
<tr><td>≥ 90</td><td>O</td><td>Outstanding</td></tr>
<tr><td>≥ 80 to < 90</td><td>S</td><td>Excellent</td></tr>
<tr><td>≥ 70 to < 80</td><td>A</td><td>Very Good</td></tr>
<tr><td>≥ 60 to < 70</td><td>B</td><td>Good</td></tr>
<tr><td>≥ 50 to < 60</td><td>C</td><td>Fair</td></tr>
<tr><td>≥ 40 to < 50</td><td>D</td><td>Satisfactory</td></tr>
<tr><td><40</td><td>F</td><td>Fail</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Write a C Program to swap two given input numbers<br>a) With using a temporary variable. b) Without using a temporary variable.</td></tr>
<tr><td>6.</td><td>Write a C Program to implement arithmetic operations using two operands and one operator using<br>a) if – else – if condition. b) Switch – Case statement.</td></tr>
<tr><td>7.</td><td>Write a C Program to print the following patterns<br>a) Floyd’s Triangle. b) Pascal Triangle.</td></tr>
<tr><td>8.</td><td>Write a C Program<br>a) To find the sum of its individual digits for a given positive number.<br>b) To check whether the given number is Prime or not.</td></tr>
<tr><td>9.</td><td>Write a C Program<br>a) To check whether the given number is a Palindrome or not.<br>b) To check whether the given number is an Armstrong or not</td></tr>
<tr><td>10.</td><td>Write a C Program using Functions to find both the largest and smallest number in an given array numbers.</td></tr>
<tr><td>11.</td><td>Write C programs to perform swapping of two numbers by passing a value and reference.</td></tr>
<tr><td>12.</td><td>Write a C Program for two Matrices by checking the compatibility<br>a) Addition. b) Multiplication.</td></tr>
</table>

| | |
|---|---|
| **13.** | Write a C program on Strings to implement the following operations without string handling functions<br>a) Concatenation of two given input strings. b)Length of a string.<br>c) Reverse of a given string. |
| **14.** | Write C programs that use both recursive and non-recursive functions for the following<br>i) To find the factorial of a given integer.<br>ii) To find the GCD (greatest common divisor) of two given integers.<br>iii) To find Fibonacci sequence |
| **15.** | Write a C program using Pointers to work on<br>a) Matrix Addition. b) Transpose of a Matrix. |
| **16.** | Write a C program to read and print the details of an Employee (Name, Date of the Birth, Designation, Salary) using Structures. |
| **17.** | Write a C program<br>a) to read and print the student details (Name, Register number, Address, Intermediate % ) using Union.<br>b) to display the name of the colour using Enum data type |
| **18.** | Write a C Program to<br>a) Copy one file to another. b)Count the number of characters, words and lines in a file. |

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**19BC1LC01**

# Engineering Chemistry Laboratory

| | | | |
|---|---|---|---|
| **CourseCategory:** | Basic sciences | **Credits:** | 1.5 |
| **CourseType:** | Lab | **Lecture-Tutorial-Practice:** | 0 -0 -3 |
| **Prerequisites:** | Basic Chemistry | **ContinuousEvaluation:** | 40 |
| | | **Semesterend Evaluation:** | 60 |

**COURSEOUTCOMES**

**Upon successful completion of the course, the student will be able to:**

| | |
|---|---|
| **CO1** | Students will learn to estimate the given amount of dissolved compounds in water by using volumetric analysis and preparation of polymers and nano particles |
| **CO2** | Students will be able to learn compelxometric titrations to determine the concentration of different metal ions present in water. |
| **CO3** | Students will be able to identify the accurate value of $P^H$ and conductivity of given solutions. and to estimate the viscosity and surface tension of given solutions. |

**Contribution of Course Outcomes towards achievement of Program Outcomes**

**(1–Low,2-Medium,3–High)**

| | PO 1 | PO2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | | | | | | | | | | | | |
| **CO2** | 2 | 1 | | 1 | | | | | | | | | | | 2 |
| **CO3** | 2 | 1 | | | | | | | | | | | | | |

## COURSECONTENT

### (Any 10 of the following listed 14 experiments)

**LIST OF EXPERIMENTS:**

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis

1. Estimation of HCI using standard $Na_2CO_3$ solutions
2. Determination of alkalinity of a sample containing $Na_2CO_3$ and NaOH
3. Estimation of $KMnO_4$ using standard Oxalic acid solution.
4. Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution
5. Determination of Temporary and permanent Hardness water using standard EDTA solution.
6. Determination of pH of the given sample solution using pH meter
7. Determination of Iron (III) using Colorimetric method
8. Conductometric Titrations between strong acid and strong base
9. Conductometric Titrations between strong acid and weak base
10. Estimation of Vitamin – C
11. Preparation of Phenol - Formaldehyde Resin
12. Determination of viscosity of a liquid
13. Determination of surface tension of a liquid
14. Preparation of Nano particles.(Cu/Zn)

## TEXTBOOKS

1. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).

2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

## REFERENCEBOOKS

[1] College designed manual

## WEB-RESOURCES

www.bsauniv.ac.in/UploadImages/Downloads/Estimation%20of%20Hardness
https://pubs.acs.org/doi/abs/10.1021/i560133a023

https://pdfs.semanticscholar.org/33d4/3b264bad212a14d660667298f12944ea11d5

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## Environmental Studies (Common to All Branches)

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | **19BE1T01** |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 0 |
| **Prerequisites** | Exposure Basic Knowledge in Environment and protection. | **InternalAssessment**<br>**Semester EndExamination**<br>**Total Marks** | 0<br>0<br>0 |

| **COURSE OBJECTIVE:** | |
|---|---|
| **1** | To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers. |

| **COURSE OUTCOMES** | | **LEVEL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Recognize the interconnectedness of human dependence on the earth's ecosystems | **K -II** |
| **CO2** | Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities | **K -I** |
| **CO3** | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century | **K -II** |
| **CO4** | Gain a higher level of personal involvement and interest in understanding and solving environmental problems. | **K -II** |
| **CO5** | Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices | **K -III** |
| **CO6** | Influence their society in proper utilization of goods and services. | **K -I** |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **CO2** | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO4** | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

## Course contents:

**UNIT – I**

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance-Need for public awareness.

**Natural Resources:**

Forest resources : deforestation – Mining, dams and other effects on forest and tribal people.
Water resources :Use and over utilization of surface and groundwater.
Food resources:World food problems, effects of modern agriculture, fertilizer-pesticide problems.
Energy resources: renewable and nonrenewable energy sources.
Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.

**LEARNING OUTCOMES:**

Students will be able to

1. *Articulate the basic structure, functions, and processes of key social systems affectingthe environment*
2. Explain why renewable and non-renewable energy resources are important..
3. Explain how water resources should be used.

**UNIT-II:Ecosystems, Biodiversity and its conservation:** Definition of Ecosystem and its structure, Functions

Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity

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**LEARNING OUTCOMES:**

Students will be able to

1. Get a clear picture of structure and functions of ecosystems.
2. Demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematic in the broad sense.

**UNIT-III: Environmental Pollution:** Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution.

**Solid Waste Management:** Sources, effects and control measures of urban and industrial waste.

**LEARNING OUTCOMES** Students will be able to

1. Understand Cause, effects and control measures of air pollution.
2. Explain the enforcement of Environmental legislation
3. Understand solid waste management.

**UNIT-IV:Social Issues and the Environment:** Air (Prevention and Control of Pollution) Act 1981. –Water (Prevention and control of Pollution) Act 1974,EPA act 1986 ,Issues involved in enforcement of environmental legislation**,** Rain water harvesting, Global Environmental challenges climate change and mitigations and Adaptations (Engineering technologies)

**LEARNING OUTCOMES:**

Students will be able to

1. Explain the enforcement of Environmental legislations
2. Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities.

**UNIT-V: Human population and the Environment:**

Population growth,Women and child welfare, Role of Information technology in environment and human health Awareness to Environmental Assessment& clearance ,Audit .Environmental Governance in india

E-Waste management Rules (Biomedical Waste, Solid Waste) **Field work: A** mini project related to Environmental issues / To visit a local polluted site (Submission of project by every student)

**LEARNING OUTCOMES** Students will have

1. *Explain various types of information technologies*
2. Explain the theories of population explosion

| **TEXT BOOKS** | |
|---|---|
| **1.** | Environmental Studies for undergraduate courses by ErachBharucha,UGC. |
| **2.** | A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company. |
| **3.** | Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai |
| **4.** | A Textbook EIA Notification 2006(2019) |
| **REFERENCE BOOKS** | |
| **1.** | Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning. |
| **2.** | Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P. |
| **3.** | Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi |
| **WEB RESOURCES** | |
| **1.** | UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES http://www.defra.gov.uk/environment/climatechange |
| **2.** | UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity |
| **3.** | UNIT-3: ENVIRONMENTAL POLLUTION https://www.omicsonline.org/environment-pollution-climate-change.php and |
| **4.** | UNIT-4: Social Issues and the Environment |

| | |
|---|---|
| | http://www.publichealthnotes.com/solid-waste-management/ |
| **5.** | UNIT-5: HUMANPOPULATION AND THE NVIRONMENT<br>http://IPCC.com |

# I B.Tech. – II Semester

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# Numerical Methods and Multi-variable Calculus

**(Common to CE, ME, ECE, CSE, &IT)**

**I B. Tech II Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 19BM2T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Differentiation, Integration | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data. | K3 |
| **CO2** | find the approximate roots of transcendental equations by using different numerical methods | K2 |
| **CO3** | solve ordinary differential equations by using different numerical schemes | K3 |
| **CO4** | Find areas and volumes using double and triple integrals | K2 |
| **CO5** | apply a range of techniques to find solutions of standard PDEs | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |

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| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Interpolation**<br>Introduction– Errors in polynomial interpolation – Finite differences – Forward differences– Backward differences –Central differences – Symbolic relations and separation of symbols – Differences of a polynomial-Newton's formulae for interpolation –Gauss formulae for interpolation- Interpolation with unequal intervals – Lagrange's interpolation formula. |
| **UNIT II** | **Solution of Algebraic and Transcendental Equations**<br>Introduction- Bisection method – Method of false position – Secant method- Iteration method – Newton-Raphson method (One variable). |
| **UNIT III** | **Numerical Integration and solution of Ordinary Differential equations**<br>Trapezoidal rule- Simpson's 1/3rd and 3/8th rule-Solution of ordinary differential equations by Taylor's series-Picard's method of successive approximations-Euler's method - Runge-Kutta method (second and fourth order). |
| **UNIT IV** | **Multiple integrals**<br>Multiple integrals: Double and triple integrals – Change of variables – Change of order of integration.<br>**Applications:** Finding Areas and Volumes. |
| **UNIT V** | **Partial Differential Equations**<br>Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. |

| TEXT BOOKS | |
|---|---|
| **1.** | **B. S. Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. |
| **2.** | **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India |
| **REFERENCE BOOKS** | |
| **1.** | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |
| **2.** | **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press |
| **3.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **4.** | **Srimanta Pal, Subodh C. Bhunia**, Engineering Mathematics, Oxford University Press. |
| **5.** | **T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications. |
| **6.** | **T.Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications |
| **WEB RESOURCES** | |
| **1.** | **UNIT I: Interpolation**<br>https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation |
| **2.** | **UNIT II: Solution of Algebraic and Transcendental Equations**<br>https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving<br>https://www.slideshare.net/100005232690054/algebraic-and-transcendental-equations |
| **3.** | **UNIT III: Numerical Integration and solution of Ordinary Differential Equations**<br>https://nptel.ac.in/courses/111107063/ |

| | |
|---|---|
| **4.** | **UNIT III: Multiple Integrals**<br>https://en.wikipedia.org/wiki/Multiple_integral<br>http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx |
| **5.** | UNIT V: **Partial Differential Equations**<br>https://en.wikipedia.org/wiki/Partial_differential_equation |

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# Integral Transforms and Vector Calculus

**(Common to CE, EEE, ME, ECE, CSE & IT)**

**I B. Tech II Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 19BM2T03 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | NIL | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | examine the properties of Laplace transformation | K3 |
| **CO2** | solve ordinary differential equations by using Laplace transformation technique | K2 |
| **CO3** | expand a periodic function as a Fourier series and find Fourier transform of a given function. | K3 |
| **CO4** | understand vector differential properties of scalar and vector point functions and their applications. | K2 |
| **CO5** | apply Green's, Stokes and Divergence theorem to evaluate line, surface and volume integrals. | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |

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| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function. |
| **UNIT II** | **Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof).<br>**Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms. |
| **UNIT III** | **Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms. |
| **UNIT IV** | **Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities. |
| **UNIT V** | **Vector Integration:** Line integral – Work done – Potential function – Area, Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems. |

| TEXT BOOKS | |
|---|---|
| **1.** | **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. |
| **2.** | **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India |
| **REFERENCE BOOKS** | |
| **1.** | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |
| **2.** | **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press |
| **3.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **4.** | **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press. |
| **5.** | **T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications. |
| **6.** | **Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline. |
| **7.** | **Shanti Narayan**, Integral Calculus – Vol. 1 & II |
| **WEB RESOURCES** | |
| **1.** | **UNIT I: Laplace transforms**<br>https://en.wikipedia.org/wiki/Laplace_transform<br>https://web.stanford.edu/~boyd/ee102/laplace.pdf |
| **2.** | **UNIT II: Inverse Laplace transforms**<br>https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php |
| **3.** | **Unit – III: Fourier Series** |

| | |
|---|---|
| | https://www.mathsisfun.com/calculus/fourier-series.html<br>https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html |
| **4.** | **UNIT IV: Vector Differentiation**<br>https://en.wikipedia.org/wiki/Vector_calculus |
| **5.** | **UNIT V: Vector Integration**<br>https://en.wikipedia.org/wiki/Divergence_theorem<br>http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx |

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## CONSTRUCTION MATERIALS

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE2T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To create a strong understanding on the importance of various building materials like bricks, tiles and lime used in Civil Engineering construction. |
| **2** | To create a strong knowledge on the manufacturing of various building materials like cement and other materials used in Civil Engineering construction. |
| **3** | To Identify the uses of wood, stones and their applications in Civil Engineering. |
| **4** | Identifying the various structural components of buildings, bridges, embankments, etc. |
| **5** | To create a strong understanding on the importance of surface finishing of a structure. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Know about various building materials like lime, brick, and tiles. (K1) |
| **CO2** | Understand about various types of cement and other construction materials. (K2) |
| **CO3** | Identify the various types of wood, stones and their uses. (K3) |
| **CO4** | Identify the structural components, sub-components and their applications. (K3) |
| **CO5** | Know the concepts of surface finishing of a structure. (K1) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 1 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 1 | 2 | -- | -- | -- | -- | -- | -- | -- | 1 | 1 | 2 | 3 |
| **CO3** | 3 | 2 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | 3 | 2 | 2 |
| **CO4** | 3 | 2 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 1 | 3 | 2 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **BRICKS, TILES & LIME**<br>Composition of good brick, methods of manufacturing of bricks. Characteristics of good tile, manufacturing methods, Types of tiles. Uses of materials like Aluminum, Gypsum, Glass and Bituminous materials – their quality.<br>**LIME:** Various ingredients, Constituents, classification and various methods of manufacture of lime. |

| | |
|---|---|
| **UNIT II** | **CEMENT & OTHER CONSTRUCTION MATERIALS**<br>**CEMENT**: Portland cement- Chemical Composition, Various types of cement and their properties.<br>**Other Construction Materials** - Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminum and soil |
| **UNIT III** | **STONE & TIMBER PRODUCTS**<br>**WOOD:** Structure, Properties, Seasoning of timber, Classification of various types of woods used in buildings, Defects in timber.<br>**STONE:** Properties of building stones, classification of stones, stone quarrying, precautions in blasting, dressing of stone, |
| **UNIT IV** | **BUILDING COMPONENTS**<br>Definitions of terms in masonry, Types of masonry-stone masonry, Brick masonry-English and Flemish bonds.<br>Different types of floors - Cement Concrete Flooring, Marble Flooring, Tiled Flooring, Timber Flooring, and Rubber Flooring.<br>**STAIRS:** Technical terms, Requirements of Good Stair, Classification of Stairs.<br>**LINTELS & ARCHES:** Classification of Lintels and Arches.<br>**DOORS AND WINDOWS:** Location of Doors and Windows-Types of Doors–Types of Windows. |
| **UNIT V** | **FINISHINGS AND PIPES**<br>Damp Proofing and water proofing materials and uses, Plastering Pointing, white washing and distempering<br>**PAINTS**: Constituents of paint, Types of paints, Painting of new/old wood, Varnish.<br>Form Works and Scaffolding<br>**PIPES:** Pipes used in building construction.<br>**ADHESIVES:** Used in timber, tile fixing, Joining concrete, cladding, sealing compounds & joint fillers. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Building Material & Construction by S.S. Bhavikatti, Vikas publishing House pvt ltd. |
| **2.** | Building Materials by B.C. Punmia, Laxmi Publications private ltd. |
| **REFERENCE BOOKS** | |
| **1.** | Building Materials by S.K.Duggal, New Age International Publications. |
| **2.** | Building Materials by P.C.Verghese, PHI learning (P) ltd. |
| **WEB RESOURCES** | |
| **1.** | http://freevideolectures.com/Course/86/Building-Materials-and-Construction |

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**< ENGINEERING PHYSICS >**

**< Common to CE & ME branches >**

| | | | |
|---|---|---|---|
| **Course Category** | BASIC SCIENCES | **Course Code** | **19BP2T01** |
| **Course Type** | Theory | **L-T-P-C** | 3 - 0 -0-3 |
| **Prerequisites** | Intermediate Physics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Study the Crystal Structures, Properties and their relationship exhibited by Solid State materials for their utility. |
| **2** | Impart knowledge on magnetic materials with characteristic utility in appliances. |
| **3** | Simple harmonic motion and its adaptability for improved acoustic quality of concert halls-Impart concepts of flaw detection techniques using ultrasonic's. |
| **4** | Impart knowledge in basic concepts of LASERs along with its Engineering applications-Familiarize types of sensors for various engineering applications |
| **5** | Impart the knowledge of Nanomaterials, Properties, characterization Techniques and Applications |

| **COURSE OUTCOMES** | | **Cognitive Level** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Apply the basics of crystal structures and X ray diffraction technique for material studies. | Application(K3) |
| **CO2** | Analyze the materials based on their magnetic properties and use them in possible applications. | Analysis(K3) |
| **CO3** | Analyze the factors behind acoustic defects and different ultrasonic testing techniques of materials using NDT | Analysis(K3) |
| **CO4** | Understand the basics principles of laser mechanism and Sensors for applications in engineering. | Understanding(K2) |
| **CO5** | Apply the knowledge of Nanomaterials and their properties for applications in engineering | Application(K3) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | 1 | | | | | | | | | | | |
| **CO2** | 2 | 2 | | | | | | | | | | | | | |
| **CO3** | 2 | 2 | | | 1 | 1 | | | | | | | | | |
| **CO4** | 2 | | | 2 | | | | | | | | | | | |
| **CO5** | 2 | 1 | | | | | | | | | | | | | |

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| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **CRYSTALLOGRAPHY & X-RAY DIFFRACTION** **(10 hrs)**<br>Introduction-Basis and lattice – Unit cell - Coordination number -Packing fraction -Bravais lattice-Crystal Systems – packing fractions of SC,BCC and FCC-Crystal directions and planes-Miller indices – Separation between successive (h k l) planes – Bragg's law - Bragg's X-ray spectrometer. |
| **UNIT II** | **MAGNETIC PROPERTIES** **(8hrs)**<br>Introduction-Magnetic-dipole-moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials(Analytical ) - Wiess theory – Domain theory -Hysteresis-eddy currents- soft and hard magnetic materials - applications |
| **UNIT III** | **ACOUSTICS** **(11 hrs)**<br>Introduction – Reverberation - Reverberation time - Sabine's formula (Jaggers' Method using Eyrings approximation)–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.<br>**ULTRASONICS**<br>Introduction-Production of ultrasonic's by Magneto-striction and piezoelectric methods – Detection of ultrasonic's- Non-Destructive Testing- pulse echo system through transmission and reflection modes - Applications. |
| **UNIT IV** | **LASERS** **(11 hrs)**<br>Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Mechanisms - Ruby laser – Helium Neon laser –Semiconductor laser– Applications<br>**SENSORS (Qualitative description only):**<br>Introduction-Strain and Pressure sensors-Piezoelectric-Magnetostrictive sensors- Temperature sensor-smoke and fire detectors-Applications. |
| **UNIT V** | **PHYSICS OF NANOMATERIALS** **(8hrs)**<br>Introduction to Basics of Nano materials, Properties - Preparation methods (Sol Gel Technique, Ball Milling) and characterization Methods Scanning tunneling Microscopy, Atomic Force Microscopy – CNTs Preparation (Arc Discharge method) and properties - Applications of NanoMaterials (CNTs). |

| **TEXT BOOKS** | |
|---|---|
| **1** | "A text book of Engineering Physics" by P G Kshirsagar& M N Avadhanulu, S Chand & Company Ltd |
| **2** | "Solid State Physics" by SO Pilai., - New age International Publishers |
| **3** | "Engineeing Physics by P.K.Palanisamy, Scitech publications (New Edition 2019) |
| **REFERENCE BOOKS** | |
| **1** | "Sensor and Transducers" by Ian R Sinclair, Elsevier (Newnes) 3rd Eds |
| **2** | Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition |
| **WEB RESOURCES** | |

| | |
|---|---|
| **1** | http://youtu.be/OTDVov_kw6A<br>https://slideplayer.com/slide/3866455/64/video/CHAPTER+3%3A+CRYSTAL+STRUCTURES+%26amp%3B+PROPERTIES.mp4<br>https://youtu.be/DYTCF01gdr0 |
| **2** | https://nptel.ac.in/courses/113106032/15%20-%20Magnetic%20Properties.pdf |
| **3** | https://www.svce.ac.in/departments/physics/downloads/Notes/Unit-IV/UNIT%20IV%20Acoustics.pdf |
| **4** | https://youtu.be/UheTlVwukWg<br>http://engineering.nyu.edu/gk12/amps-cbri/pdf/Intro%20to%20Sensors.pdf |
| **5** | https://nccr.iitm.ac.in/2011.pdf<br>https://youtu.be/lFYs3XDu4fQ |

**ENGINEERING DRAWING**
**(Only for CE)**

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Science | **Course Code** | 19ME2T01 |
| **Course Type** | Theory | **L-T-P-C** | 1-0-3-2.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the students to use drawing instruments and to draw polygons, Engineering Curves and Scales. |
| **2** | To introduce the students to use orthographic projections, projections of points and lines. |
| **3** | To make the students draw the projections of the planes. |
| **4** | To make the students draw the projections of the various types of solids. |
| **5** | To represent the object in 3D view through isometric views. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level*** |
| **CO1** | Construct polygons, scales and engineering curves. | k3 |
| **CO2** | Identify the position of points and lines with use of orthographic projections. | k3 |
| **CO3** | Analyze the location and position of plane figures through orthographic projections. | k4 |
| **CO4** | Analyze the location and position of solid bodies through orthographic projections. | k4 |
| **CO5** | Develop 2D and 3D objects by converting their views. | k6 |

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5- Evaluating, k6- Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 1 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | Introduction to Engineering Drawing.<br>**Polygons:** Constructing regular polygons by general method. |

| | |
|---|---|
| | **Curves:** Parabola, Ellipse and Hyperbola by general methods tangent & normal for the curves. Cycloid and Involutes.<br>**Scales:** Vernier and Diagonal scales. |
| **UNIT II** | **Orthographic Projections:** Introduction, importance of reference lines, projections of points in various quadrants. Projections of straight lines inclined to both the planes, determination of true lengths and angle of inclination. |
| **UNIT III** | **Projections of planes:** Regular planes perpendicular/parallel to one plane.<br>Regular planes inclined to one plane and parallel to other, inclined to both the planes. |
| **UNIT IV** | **Projections of Solids:** Simple positions of Prisms, Pyramids, Cones and Cylinders. Solids inclined to both the planes. |
| **UNIT V** | **Isometric Projections:** Introduction, Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric views.<br>Introduction to AutoCAD (Demo only) |

| **TEXT BOOKS** | |
|---|---|
| **1** | Engineering Drawing by N.D. Bhatt, Chariot Publications, 56th Edition. |
| **2** | Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age International (P) Limited (2008). |
| **REFERENCE BOOKS** | |
| **1** | Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers, 3rd Edition. |
| **2** | Engineering Graphics for Degree by K.C. John, PHI Publishers. |
| **3** | Engineering Graphics by PI Varghese, Mc Graw Hill Publishers, 2013. |
| **4** | Engineering Drawing by Basant Agarwal, Tata McGraw Hill Publishers, 2014. |
| **5** | B.V.R. Gupta & M. Raja Roy, Engineering Drawing, I.K. International Publishing House Pvt. Ltd., 2009. |
| **WEB RESOURCES** | |
| **1** | http://nptel.ac.in/courses/112103019/ |
| **2** | http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html |
| **3** | https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_health_science_students/engineeringdrawing.pdf |

# ENGINEERING WORKSHOP & IT WORKSHOP*
## (Only for CE)

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Science | **Course Code** | 19ME2L01 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Prerequisites** | | **Internal Assessment** | 40 |
| | | **Semester End Examination** | 60 |
| | | **Total Marks** | 100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To familiarize with the basic material removal/shaping processes. |
| **2** | To study the various tools and equipment used in different hands on sessions. |
| **3** | To develop a skill in dignity of labor, precision, safety at work place. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Practice on manufacturing of components using workshop trades including fitting and carpentry. |
| **CO2** | Design different types of models by using workshop trades including black smithy and tin smithy. |
| **CO3** | Apply basic electrical engineering knowledge for house wiring practice. |

**Contribution of Course Outcomes towards achievement of Program Outcomes**
**(1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | 3 | - | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO2** | 3 | - | 3 | - | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO3** | 3 | - | 3 | - | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |

**LIST OF EXPERIMENTS**

**A. Carpentry:**

1. T-Lap Joint
2. Cross Lap Joint

| |
|---|
| 3. Dovetail Joint<br>4. Mortise and Tenon Joint |
| **B. Fitting:**<br>1. V Fit<br>2. Square Fit<br>3. Half Round Fit<br>4. Dovetail Fit |
| **C. Black Smithy:**<br>1. Round rod to Square<br>2. S-Hook<br>3. U- Hook<br>4. Round Rod to Flat Ring |
| **D. House Wiring:**<br>1. Parallel Connection of three bulbs<br>2. Series Connection of three bulbs<br>3. Stair Case wiring<br>4. Florescent Lamp Fitting |
| **E. Tin Smithy:**<br>1. Square Box without lid<br>2. Open Scoop<br>3. Taper Tray<br>4. Funnel |

Note: At least eight exercises to be done covering at least 4 trades**.**

**IT WORKSHOP**

| **COURSE CONTENT** | |
|---|---|
| **1** | **Identification of peripherals of a computer**. To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O devices, power rating of computers. |
| **2** | A practice on disassembling the components of a PC and assembling them to back to working condition. |
| **3** | **Hardware trouble shooting (Demonstration):** Identification of a problem and fixing a defective PC (improper assembly of peripherals) |
| **4** | **Software troubleshooting (Demonstration):** Identification of a problem and fixing the PC for any software issues. |
| **5** | **MS Word** –Formatting, Page Borders, Equations and Symbols .<br><br>**MS Excel**-Organize data, Usage of formula, Graphs and Charts.<br><br>**MS PowerPoint**-Guidelines for preparing an effective presentation. |
| **6** | **Operating system installation:**-Install Operating Systems like Windows, Linux along with necessary Device Drivers. |

*As a part of this course, 'Engineering Workshop' syllabus to be ratified by BoS-**Mechanical Engineering Department** and 'IT workshop' syllabus to be ratified by BoS-**CSE Department**, where as subject code to be given by Mechanical Engineering Department

**Subject Code: 19HE2L02**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

## PROFESSIONAL COMMUNICATIVE ENGLISH LAB- II
**(For CE, EEE, CSE & IT)**

**PRESCRIBED LAB MANUAL FOR SEMESTER II:**

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills', Published by Maruthi Publications.

**OBJECTIVES:** To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

**OUTCOME:** A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content along with the study material is divided into six units.

**UNIT-1:**
Small Talk & JAM Session

**UNIT-2:**
Interviews

**UNIT-3:**
Effective Telephonic Interviews

**UNIT-4:**
Group Discussions

**UNIT-5:**
Presentations & Public Speaking

**UNIT-6:**
Debates

**<ENGINEERING PHYSICS LABORATORY>**

**< Common to CE & ME)>**

| | | | |
|---|---|---|---|
| **Course Category** | BASIC SCIENCES | **Course Code** | **19BP2T01** |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Course Type** | Lab | **L-T-P-C** | 0 - 0 - 3-1.5 |
| **Prerequisites** | Intermediate Physics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The student will have exposure to various experimental skills which is essential for an Engineering student. |
| **2** | To gain practical knowledge by applying the experimental methods to correlate with the Theoretical Physics. |
| **3** | Apply the Analytical techniques and graphical analysis to the experimental data |

| **COURSE OUTCOMES** | | **Cognitive Level** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Understand the basics of Mechanics, Elasticity, Diffraction using instruments like Fly wheel, Stewart Gee's, Grating | Understanding(K2) |
| **CO2** | Understand the basics of Waves and Oscillations in Physics using instruments like Volume Resonator,Sonometer. | Application(K3) |
| **CO3** | Determine the Magnetic and Dielectric constants of materials | Application(K3) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | | | | | | | | | | | | | |
| **CO2** | 2 | | | | | | | | | | | | | | |
| **CO3** | 2 | 2 | 2 | | | | | | | | | | | | |

| **COURSE CONTENT: (Any 10 of the following listed 12 experiments)** | |
|---|---|
| **1.** | Determination of Rigidity modulus of a material- Torsional Pendulum. |
| **2.** | Determination of Young's modulus by method of single cantilever oscillations. |

| | |
|---|---|
| **3.** | Determination of Acceleration due to Gravity and Radius of Gyration - Compound Pendulum. |
| **4.** | Verification of laws of vibrations in stretched strings – Sonometer. |
| **5.** | Determination of ultrasonic velocity in liquid (Acoustic grating) |
| **6.** | Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus |
| **7.** | Study the variation of B versus H by magnetizing the magnetic material (B-H curve). |
| **8.** | Determination of dielectric constant by charging and discharging method |
| **9.** | Determination of wavelength of Laser by diffraction grating |
| **10.** | Determination of particle size using Laser. |
| **11.** | Determination of Moment of Inertia of a Fly Wheel. |
| **12.** | Determination of Velocity of sound –Volume Resonator. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers) |
| **REFERENCE BOOKS** | |
| **1.** | College customized manual |
| **WEB RESOURCES** | |
| **1.** | https://youtu.be/P-eJIXZimmQ |
| **2.** | https://youtu.be/iUhfstf10rk |
| **3.** | https://www.youtube.com/watch?v=BX4QPdP7fT8 |
| **4.** | https://youtu.be/toggy3WVxV4 |
| **5.** | https://www.youtube.com/watch?v=AYQLmFqFtlw |
| **6.** | https://www.youtube.com/watch?v=9MBE5t1Sv_w |

**Constitution of India**
(Common to all branches) Code:19HM2T05

| | | | |
|---|---|---|---|
| **Course Category** | Humanities including Management | **Credits** | 0 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Course Type** | Theory | **Lecture-Tutorial-Practice** | 2 -0 -0 |
| **Prerequisites** | | **Total Marks (Internal Assessment)** | 100 |

| **Course Outcomes** | | **Blooms Taxonomy Level** |
|---|---|---|
| **On successful completion of the course, the student will be able to** | | |
| **CO 1** | Understand the evolution of Constitution of India | Understanding |
| **CO 2** | Make use of their Fundamental rights. | Application |
| **CO 3** | Understand the functioning of the Union Government | Understanding |
| **CO 4** | Understand the functioning of the State and local self Government. | Understanding |
| **CO 5** | Understand the value of Indian Constitution in functioning of the country. | Understanding |

| **Contribution of Course Outcomes towards achievement of Program** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Outcomes: 1 – Low, 2 - Medium, 3 – High | | | | | | | | | | | |
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** |
| **CO1** | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 1 | 0 | 2 |
| **CO2** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 1 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| **CO4** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 2 |

**Course Content :**

**Unit – I**

**Introduction to Indian constitution:** Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.

**Unit –II**

**Fundamental Rights and Directive principles of state policy:** Individual and Collective Rights – Limitations of the fundamental Rights – Judicial Interpretation of Fundamental Rights.

**Unit –III**

**Union Government:** Union Legislature – Lok sabha and Rajya sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions).

**Unit – IV State and Local self Government:**

**State Government:** State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions)

**Local Self Government:** Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)

**Unit – V Working of the Indian Constitution**

The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

**Reference Books** :

1. 'Indian Polity' by Laxmikanth

2. 'Indian Administration' by Subhash Kashyap

3. 'Indian Constitution' by D.D. Basu

4. 'Indian Administration' by Avasti and Avasti

**Web Resources:**

1. https://www.clearias.com/historical-background-of-indian-constitution/

2. https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html

3.https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

# II B.Tech. – I Semester

**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

**(For B.Tech CE)**

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | **19EE3T02** |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | NA | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn the basic principles of electrical circuit analysis. |
| **2** | To understand constructional details and operating principle of DC machines & Transformers. |
| **3** | To understand constructional details and operating principle details of alternator and3-Phase induction motor. |
| **4** | To study operation of PN junction diode, half wave, full wave rectifiers, PNP and NPN transistors and various semiconductor devices. |
| **5** | To study the operation of OP-AMPs. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Analyze various electrical circuits | Analyzing |
| **CO2** | Understand constructional details and operating principle of DC machines, single phase transformer, tests and analyze their performance. | Analyzing |
| **CO3** | Explain operation of Three phase AC machines. | Understanding |
| **CO4** | Analyze operation of half wave, full wave bridge rectifiers and Explain single stage CE amplifier and concept of various semiconductor devices. | Analyzing |
| **CO5** | Analyze operation of OP-AMPs. | Analyzing |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| **CO3** | 3 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| **CO4** | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **CO5** | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Electrical Circuits**<br>Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations. |
| **UNIT II** | **DC Machines & Transformers**<br>Constructional details and operating principle – EMF equation –DC motor – torque equation – applications - speed control methods of DC motor – Swinburne's Test.<br>Constructional details and operating principle of single phase transformers – EMF equation – equivalent circuit – Losses – OC & SC tests – efficiency. |

| | |
|---|---|
| **UNIT III** | **AC Machines**<br>Constructional details and operating principle of alternators – types –Regulation of alternator by synchronous impedance method.<br><br>Principle of operation of 3-Phase squirrel cage induction motor – electromagnetic torque equation - power flow - brake test - efficiency calculation – applications. |
| **UNIT IV** | **Semiconductor Devices**<br>PN junction diodes – characteristics – half wave and full wave rectifiers - PNP and NPN junction transistor, transistor as an amplifier – transistor amplifier – frequency response of CE amplifier – concepts of feedback amplifier – SCR – MOSFET - IGBT. |
| **UNIT V** | **Operational Amplifiers**<br>Introduction to operation amplifiers (Ideal OP-AMP) – Characteristics – applications (inverting, non-inverting, integrator and differentiator). |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | William Hayt and Jack E. Kemmerley, Engineering Circuit Analysis, Mc Graw Hill Company, 6th Edition. |
| **2.** | Surinder Pal Bali, Electrical Technology, Vol-I, Vol-II, Pearson Publications, 1st Editiom. |
| **3.** | Basic Electrical and Electronics Engineering by M.S. Sukhija and T.K. Naga Sarkar, Oxford University Press. |
| **4.** | R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, PEI/PHI 2006, 9th Edition. |
| **REFERENCE BOOKS** | |
| **1.** | John Bird, Electrical Circuit Theory and Technology, Routledge Taylor and Francis Group, 5th Edition. |
| **2.** | M.S.Naidu and S.Kamakshiah, Basic Electrical Engineering, TMH Publications, 1st Edition. |
| **3.** | Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publications, 2nd edition. |
| **4.** | R. S. Sedha, A Text Book of Electronic Devices and Circuits, S.Chand & Co. 2nd Edition |
| **5.** | David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5th Edition. |
| **WEB RESOURCES (Suggested)** | |
| **1.** | http://www.ncert.nic.in/html/learning_basket/electricity/electricity/machine/motor.html |
| **2.** | www.electricaleasy.com |
| **3.** | www.nptel.ac.in/courses/108108076/ |
| **4.** | https://nptel.ac.in/courses/122106025/ |

## Probability & Statistics

**(Common to CE, CSE & IT)**

**II B. Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Prerequisites** | NIL | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies | K3 |
| **CO2** | interpret the properties of normal distribution and its applications | K2 |
| **CO3** | find the confidence intervals for a statistic from the given population | K3 |
| **CO4** | apply the concept of hypothesis testing to real world problems | K2 |
| **CO5** | find a curve which approximate the given data, coefficient of correlation and lines of regression. | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 3 | - | 2 | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 1 | 2 | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 1 | 2 | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Discrete Distributions:** Introduction – Discrete Random variables – Distribution function – Discrete distribution: Binomial and Poisson distributions. |
| **UNIT II** | **Continuous distributions:** Introduction -Continuous Random variables – Normal distributions, standard normal distribution, normal approximation to Binominal, Gamma and Weibull distributions. |
| **UNIT III** | **Sampling Theory:** Introduction – Population and samples – Sampling distribution of means for large and small samples (with known and unknown variance) – Proportion, sums and differences of means – Sampling distribution of variance – Point and interval estimation. |

| | |
|---|---|
| **UNIT IV** | **Test of Hypothesis:** Introduction – Type I and Type II errors – Maximum error – One tail and two tail tests –Tests concerning single mean, two means and several means. Tests concerning single, two and several proportions – Problems using Z-test, t-test, F-test and Chi –square test. |
| **UNIT V** | **Curve fitting and Correlation:** Introduction- Method of least squares – Fitting a straight line – Second degree curve – exponential curve – power curve. Simple correlation and regression – rank correlation – multiple linear regression. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | **Miller and John E. Freund,** Probability and Statistics for Engineers, Prentice Hall of India. |
| **2.** | **B.V. Ramana,** Higher Engineering Mathematics, Tata Mcgraw Hill. |
| **REFERENCE BOOKS** | |
| **1.** | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |
| **2.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **3.** | **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press. |
| **4.** | **S.L. Myers, K. Ye, Ronald E Walpole,** Probability and Statistics for Engineers and Scientists, Pearson, 8th Edition. |
| **WEB RESOURCES** | |
| **1.** | **UNIT I: Discrete Distributions**<br>https://en.wikipedia.org/wiki/List_of_probability_distributions<br>https://en.wikipedia.org/wiki/Binomial_distribution |
| **2.** | **UNIT II: Continuous distribution**<br>https://en.wikipedia.org/wiki/Normal_distribution |
| **3.** | **UNIT III: Sampling Theory**<br>https://en.wikipedia.org/wiki/Sampling_(statistics)<br>https://nptel.ac.in/courses/111104073/ |
| **4.** | **UNIT IV: Test of Hypothesis**<br>https://en.wikipedia.org/wiki/Statistical_hypothesis_testing<br>https://machinelearningmastery.com/statistical-hypothesis-tests/ |
| **5.** | **UNIT V: Curve fitting and Correlation**<br>https://en.wikipedia.org/wiki/Regression_analysis<br>https://www.surveysystem.com/correlation.htm |

## BUILDING PLANNING AND DRAWING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | **19CE3T02** |
| **Course Type** | Theory | **L-T-P-C** | 1 - 0 - 4 - 3 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Prerequisites** | Exposure to Construction Materials | **Internal Assessment** | 40 |
| | | **Semester End Examination** | 60 |
| | | **Total Marks** | 100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Creating an idea to the student to different building bye-laws and regulations. |
| **2** | Imparting the planning aspects of residential buildings and public buildings. |
| **3** | Drawing the various signs and bonds and different components buildings.. |
| **4** | Imparting the skills and methods of planning of various buildings. |
| **5** | |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain various building bye-Laws laid by town planning authorities and local regulatory bodies. (K2) |
| **CO2** | Apply techniques for effective project planning and management. (K3) |
| **CO3** | Plan the different types of residential buildings and various public buildings based on the minimum requirements. (K3) |
| **CO4** | Develop the building drawing as per standards in various phases of a project and detailing in construction. (K3) |
| **CO5** | Creating and awareness of basic elements of drawing. (K2) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | -- | -- | 1 | 1 | -- | 3 | 3 | 1 | 1 | -- | -- | 2 | -- | -- | -- |
| **CO2** | -- | -- | -- | -- | -- | -- | 2 | -- | 1 | -- | -- | 2 | -- | -- | -- |
| **CO3** | -- | -- | -- | -- | -- | -- | 2 | 1 | 1 | 1 | 1 | 1 | -- | -- | -- |
| **CO4** | -- | 1 | -- | -- | -- | -- | 2 | 1 | 1 | 1 | 1 | 1 | -- | -- | -- |
| **CO5** | -- | 1 | -- | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | -- | -- | -- |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **BUILDING BYELAWS AND REGULATIONS**<br>Introduction- terminology- objectives of building byelaws - principles under laying building bye laws- classification of buildings- - Floor Area Ratio (FAR). Floor Space Index (FSI).Open space requirements – built up area limitations- height of buildings- wall thickness – lightening and ventilation requirements- Principles of Vaasthu in building planning. |
| **UNIT II** | **PLANNING OF RESIDENTIAL BUILDING & PUBLIC BUILDINGS**<br>Planning of Residential building and grouping of rooms, planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation. Requirements and - Requirements and Minimum Standards for various Public Buildings. |

| | |
|---|---|
| **UNIT III** | **SIGN CONVENTIONS**<br>Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminium alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles.<br>**BONDS:** English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner. |
| **UNIT IV** | **DOORS, WINDOWS, VENTILATORS AND ROOFS**<br>Panelled door, panelled and glassed door, glassed windows, panelled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings. |
| **UNIT V** | **ELEVATION OF RESIDENTIAL BUILDING & PUBLIC BUILDINGS**<br>Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram-staircases. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Planning and Design of buildings by Y.S. Sane |
| **2.** | Planning, designing and Scheduling by Gurucharan Singh and Jagadish Singh |
| **REFERENCE BOOKS** | |
| **1.** | Building drawing by Shah and Kale. |
| **2.** | The Hindu Science of Architecture and Vaasthu , D.N.Sukhla |
| **3** | Building planning and drawing by M. Chakravarthi |

## FLUID MECHANICS

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE3T03 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Prerequisites** | Engineering Mechanics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Hydraulics. |
| **2** | To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass in fluid flow |
| **3** | To imbibe basic laws and equations used for analysis of dynamic fluids |
| **4** | To determine the losses in a flow system, flow through pipes, flow past immersed bodies |
| **5** | To study the applications of the Bernoulli's equation and different types of mouth piece |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Know the definitions of fundamental concepts of fluid mechanics. (K1) |
| **CO2** | Identify the nature of flow in pipe and hydrostatic forces acting on submerged static fluid. (K3) |
| **CO3** | Calculate the pressure and velocities by using the Bernoulli's equation and momentum equation. (K3) |
| **CO4** | Estimate the head losses in a closed conduit flow interconnected with Reynolds number. (K3) |
| **CO5** | Justify the rate of flow through channels by using flow measurement devices. (K5) |

**Contribution of Course Outcomes towards achievement of Program**

**Outcomes (1 – Low, 2 - Medium, 3 – High)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **CO2** | 2 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | 2 |
| **CO3** | 2 | 2 | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | -- | 2 |
| **CO4** | 2 | 1 | 1 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | -- | 2 |
| **CO5** | 2 | 1 | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | -- | 1 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **INTRODUCTION :** Dimensions and units, Physical properties of fluids, specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law- Relationship between pressures.<br>**Measurement of pressure**-Pressure gauges, Manometers: Differential and Micro Manometers. |
| **UNIT II** | **HYDROSTATICS:** Hydrostatic forces on submerged plane-Horizontal, Vertical, inclined and curved surfaces – Centre of pressure. Derivations and problems.<br>**FLUID KINEMATICS:** Description of fluid flow, Stream line, path line and streak lines and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, Flow net; Vortex flow – free vortex and forced, vertex flow |

| | |
|---|---|
| **UNIT III** | **FLUID DYNAMICS:** Surface and body forces:<br>Euler's and Bernoulli's equations for flow along a stream line for 3-D flow, Navier – Stokes equations (Explanatory).<br>**Momentum equation** and its application – forces on pipe bend. |
| **UNIT IV** | **LAMINAR FLOW**: Reynolds's experiment – Characteristics of Laminar & Turbulent flows. Flow between parallel plates, Flow through long tubes, flow through inclined tubes.<br>**CLOSED CONDUIT FLOW:** Laws of Fluid friction – Darcy's equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line. Pipe network problems, Moody's Chart. |
| **UNIT V** | **MEASUREMENT OF FLOW:** Pitot tube, Venturimeter and Orifice meter– classification of orifices, small orifice and large orifice, flow over rectangular, triangular and trapezoidal and stepped notches - Broad crested weirs. Classification of mouthpieces; Flow through external and internal cylindrical mouthpiece. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010. |
| **2.** | R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House |
| **2.** | Introduction to Fluid Machines by Edward J. Shaughnessy, Jr, Ira M.Katz and James P. Schaffer, Oxford University Press, New Delhi |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/105101082/ |

## STRENGTH OF MATERIALS - I

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE3T04 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| | | | |
|---|---|---|---|
| **Prerequisites** | Exposure to Engineering Mechanics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress strain behavior of materials and their governing laws. |
| **2** | To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions and to draw shear force and bending moment diagrams. |
| **3** | To give the concept of flexure stresses in beams of various cross sections |
| **4** | To give the concept of shear stress in beams of various cross sections |
| **5** | To give the concept of deflection of beams under various loading conditions |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Relate to simple stresses, strains, elastic moduli and temperature stress (K2) |
| **CO2** | Calculate and draw shear force and bending moment diagrams of beams for given boundary conditions and loading conditions. (K3) |
| **CO3** | Find the flexural stresses and draw stress distribution for various sections. (K1) |
| **CO4** | Determine and draw the shear stress distribution for various beam sections. (K3) |
| **CO5** | Measure the deflections in beams under various loading and support conditions. (K3) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | -- | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| CO2 | 3 | 3 | 2 | 2 | -- | 1 | -- | -- | -- | 2 | -- | 2 | -- | 2 | -- |
| CO3 | 3 | 3 | 1 | -- | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| CO4 | 3 | 3 | 1 | -- | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| CO5 | 3 | 3 | 2 | 2 | -- | 1 | -- | -- | -- | 2 | -- | 2 | -- | 2 | -- |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **SIMPLE STRESSES AND STRAINS:** Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – strain energy- gradual &sudden loads, Lateral strain, Poisson's ratio and volumetric strain – Elastic modulii and the relationship between them – Bars of varying section – composite bars – Temperature stresses. |
| **UNIT II** | **SHEAR FORCE AND BENDING MOMENT:** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load., uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam. |
| **UNIT III** | **FLEXURAL STRESSES:**<br>Theory of simple bending – Assumptions –Derivation of bending equation: M/I = f/y = E/R |

| | |
|---|---|
| | Neutral axis – Determination bending stresses.<br>Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections. |
| **UNIT IV** | **SHEAR STRESSES:** Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, built up beams, shear centre for Channel Sections and I-Sections |
| **UNIT V** | **DEFLECTION OF BEAMS:** Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. Uniformly varying load.-Mohr's theorems – Moment area method – application to simple cases including overhanging beams. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Mechanics of Materials- by R. C. Hibbler |
| **2.** | Strength of materials by R.K.Bansal |
| **REFERENCE BOOKS** | |
| **1.** | Fundamentals of Solid Mechanics M.L. Gambhir, PHI Learning Pvt. Ltd., New Delhi |
| **2.** | Introduction to text book of Strength of Material by U.C. Jindal, Galgotia publications. |
| **3.** | Strength of materials by S.S. Bhavakatti |
| **WEB RESOURCES** | |
| **1.** | **www.nptel.ac.in/courses** |
| **2.** | https://theconstructor.org/ |

## GEODESY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE3T05 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the students to basic principles of surveying. |
| **2** | To demonstrate the basic surveying skills. |
| **3** | To perform various methods of linear and angles measurements. |
| **4** | To enable the students to use surveying equipments. |
| **5** | To integrate the knowledge and produce topographical map. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Illustrate the fundamentals in chain and plane table surveying. (K2) |
| **CO2** | Identify the angles on filed by compass survey. (K3) |
| **CO3** | Apply knowledge of leveling in surveying. (K3) |
| **CO4** | Measure the horizontal and vertical angles by using theodolite and Total Station instruments. (K3) |
| **CO5** | Estimate the volume and area of irregular boundaries of filed. (K3) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | -- | -- | 1 | -- | -- | -- | -- | 3 | -- | -- | 2 | 3 | -- | 2 |
| **CO2** | 3 | 3 | 1 | 2 | -- | -- | -- | -- | 2 | -- | -- | 2 | 3 | -- | 2 |
| **CO3** | 3 | -- | -- | 2 | -- | -- | -- | -- | 3 | -- | -- | | 2 | -- | 3 |
| **CO4** | 3 | 3 | 1 | 3 | 3 | -- | -- | -- | 3 | -- | -- | 2 | 3 | -- | 3 |
| **CO5** | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | 3 | 2 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **INTRODUCTION:** Definition-Uses of surveying, Objectives, Principles and Classifications of Surveying – Errors in survey measurements.<br><br>**DISTANCE MEASUREMENT CONVENTIONS AND METHODS:** Use of chain and tape, Errors and corrections to linear measurements, overview of plane table surveying. |
| **UNIT II** | **COMPASS SURVEY:** Definition- Principles of Compass survey - Meridians, Azimuths and Bearings, declination. Computation of angle - Purpose and types of Traversing - traverse adjustments – Local attraction.<br><br>**CURVES:** Types of curves, design and setting out. |
| **UNIT III** | **LEVELING:**<br>Concept and Terminology, Leveling Instruments and their Temporary and permanent adjustments- method of leveling.<br>**CONTOURING:**<br>Characteristics and Uses of contours- methods of conducting contour surveys and their plotting. |
| **UNIT IV** | **THEODOLITE:** Theodolite, description, principles - uses – temporary and permanent adjustments, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Omitted Measurements. Introduction to geodetic surveying - Total Station and |

| | |
|---|---|
| | Global Positioning System.<br><br>**TACHEOMETRIC SURVEYING:** Stadia and tangential methods of Tachometry. |
| **UNIT V** | **COMPUTATION OF AREAS AND VOLUMES:** Computation of areas along irregular boundaries and regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Basic Surveying by walter whyte & Raymond paul, phi publisher. |
| **2.** | Surveying (Vol No.1, 2 &3) by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd, New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | Text book of Surveying by S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi. |
| **2.** | Text book of Surveying by Arora (Vol No. 1&2), Standard Book House, Delhi. |
| **3.** | Text book of Surveying by C. Venkataramaiah, University press, India (P) limited. |
| **WEB RESOURCES** | |
| **1.** | https://lecturenotes.in/notes/2827-note-for-surveying-1-s-1-by-swadhina-priyadarsini |
| **2.** | https://nptel.ac.in/courses/105107122/1 |
| **3.** | https://nptel.ac.in/courses/105107158/ |

## STRENGTH OF MATERIALS LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE3L01 |
| **Course Type** | Practical | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Exposure to Engineering Mechanics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To determine the deflections, young's modulus in beams |
| **2** | To determine the torsion in circular shafts |

| | |
|---|---|
| **3** | To determine the impact value for given specimen |
| **4** | To determine the spring constant in open and closed coiled helical springs |
| **5** | To determine compression in the given specimen |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Develop the relationship between the stress and strain. (K3) |
| **CO2** | Find the deflections and flexural behavior of different beams. (K1) |
| **CO3** | Relate to the concept of the torsion. (K2) |
| **CO4** | Compute the impact value of the specimen. (K3) |
| **CO5** | Find the compression strength of the given specimen. (K1) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | -- | 1 | -- | 1 | -- | -- | 2 | 1 | -- | 2 | -- | 2 | -- |
| CO2 | 3 | 2 | -- | 1 | -- | 1 | -- | -- | 2 | 1 | -- | 2 | -- | 2 | -- |
| CO3 | 3 | 2 | -- | 1 | -- | 1 | -- | -- | 2 | 1 | -- | 2 | -- | 2 | -- |
| CO4 | 3 | 2 | -- | 1 | -- | 1 | -- | -- | 2 | 1 | -- | 2 | -- | 2 | -- |
| CO5 | 3 | 2 | -- | 1 | -- | 1 | -- | -- | 2 | 1 | -- | 2 | -- | 2 | -- |

| **COURSE CONTENT** | |
|---|---|
| **S.NO** | **NAME OF THE EXPERIMENT** |
| **1** | Tension test on Mild Steel bar. |
| **2** | Bending test on (Steel / Wood) Cantilever beam. |
| **3** | Bending test on simple support beam |
| **4** | Torsion test |
| **5** | Hardness test |
| **6** | Spring test |
| **7** | Compression test on wood or concrete |
| **8** | Impact test |
| **9** | Shear test |
| **10** | Verification of Maxwell's Reciprocal theorem on beams. |
| **11** | Use of Electrical resistance strain gauges |
| **12** | Continuous beam – deflection test. |

| **LIST OF MAJOR EQUIPMENT** | |
|---|---|
| **S.NO** | **NAME OF THE EQUIPMENT** |

| | |
|---|---|
| **1** | UTM for conducting tension test on rods |
| **2** | Steel beam for flexure test |
| **3** | Wooden beam for flexure test |
| **4** | Torsion testing machine |
| **5** | Brinnell's / Rock well's hardness testing machine |
| **6** | Setup for spring tests |
| **7** | Compression testing machine |
| **8** | Izod & Charpy Impact machine |
| **9** | Shear testing machine |
| **10** | Beam setup for Maxwell's theorem verification. |
| **11** | Continuous beam setup |
| **12** | Continuous beam – deflection test. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Mechanics of Materials- by R. C. Hibbler |
| **2.** | Strength of materials by R.K.Bansal |
| **3.** | Strength of materials by S.S. Bhavakatti |
| **REFERENCE BOOKS** | |
| **1.** | Fundamentals of Solid Mechanics M.L. Gambhir, PHI Learning Pvt. Ltd., New Delhi |
| **2.** | Introduction to text book of Strength of Material by U.C. Jindal, Galgotia publications. |
| **WEB RESOURCES** | |
| **1.** | **www.nptel.ac.in/courses** |
| **2.** | https://theconstructor.org/ |

## GEODESY LABORATORY-I

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE3L02 |
| **Course Type** | Practical | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To accomplish the chain surveying for linear measurements. |
| **2** | To Decide the Horizontal angles by compass surveying. |
| **3** | To Draw the maps of the areas by plane table surveying. |

| | |
|---|---|
| **4** | To discriminate the levels of undulated ground by auto level. |
| **5** | To implement the leveling to know the road profile. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Compute the road widening and area by chain surveying. (K3) |
| **CO2** | Survey the given area by compass surveying. (K3) |
| **CO3** | Prepare maps for given land by plane table surveying. (K3) |
| **CO4** | Differentiate various levels for specified areas. (K2) |
| **CO5** | Design the road profile by auto level. (K3) |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | -- | -- | 1 | -- | -- | -- | -- | 3 | -- | -- | 2 | 3 | -- | 2 |
| **CO2** | 3 | 3 | 1 | 2 | -- | -- | -- | -- | 2 | -- | -- | 2 | 3 | -- | 2 |
| **CO3** | 3 | -- | -- | 2 | -- | -- | -- | -- | 3 | -- | -- | -- | 2 | -- | 3 |
| **CO4** | 3 | 3 | 1 | 3 | 3 | -- | -- | -- | 3 | -- | -- | 2 | 3 | -- | 3 |
| **CO5** | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | 3 | 2 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **S.No** | **List of Experiments** |
| **1.** | Survey by chain survey of road profile with offsets in case of road widening. |
| **2.** | Survey in an area by chain survey (Closed circuit). |
| **3.** | Finding the area of the given boundary using compass (Closed Traverse). |
| **4.** | Determination of distance between two inaccessible points by using compass. |
| **5.** | Plane table survey: finding the area of a given boundary by the method of Radiation. |
| **6.** | Plane table survey: finding the area of a given boundary by the method of intersection. |
| **7.** | Fly leveling: Height of the instrument method (differential leveling). |
| **8.** | Fly leveling: rise and fall method. |
| **9.** | Fly leveling: closed circuit/ open circuit. |
| **10.** | Fly leveling: Longitudinal Section and Cross sections of a given road profile. |

| | |
|---|---|
| **11.** | Two Point Problem by the plane table survey. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Surveying (Vol No.1, 2 &3) by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd, New Delhi. |
| **2.** | Advance Surveying by Satish Gopi, R. Sathi Kumar and N. Madhu, Pearson Publications. |
| **REFERENCE BOOKS** | |
| **1.** | Text book of Surveying by S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi. |
| **2.** | Text book of Surveying by Arora (Vol No. 1&2), Standard Book House, Delhi. |
| **3.** | Text book of Surveying by C. Venkataramaiah, University press, India (P) limited. |
| **WEB RESOURCES** | |
| **1.** | https://lecturenotes.in/notes/2827-note-for-surveying-1-s-1-by-swadhina-priyadarsini |
| **2.** | https://nptel.ac.in/courses/105107122/1 |
| **3.** | https://nptel.ac.in/courses/105107158/ |

**Professional Ethics and Human Values**
(Common to all branches) Code:19HM3T07

| | | | |
|---|---|---|---|
| **Course Category** | Humanities including Management | **Credits** | 0 |
| **Course Type** | Theory | **Lecture-Tutorial-Practice** | 2 -0 -0 |
| **Prerequisites** | | **Total Marks (Internal Assessment)** | 100 |

| **Course Outcomes** | **Blooms Taxonomy Level** |
|---|---|
| **On successful completion of the course, the student will be able to** | |

| | | |
|---|---|---|
| **CO 1** | Understand different concepts in Professional Ethics and Human Values. | Understanding |
| **CO 2** | Apply ethical principles to resolve the problems that arise in work place. | Applying |
| **CO 3** | Make use of Engineers rights to fulfill their responsibilities. | Applying |
| **CO 4** | Understand the responsibility of an engineer in designing safety. | Understanding |
| **CO 5** | Analyze the social media accounts in order to create and maintain a positive digital footprint. | Analyzing |

| **Contribution of Course Outcomes towards achievement of Program** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Outcomes: 1 – Low, 2 - Medium, 3 – High | | | | | | | | | | | |
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** |
| **CO1** | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 3 | 0 | 2 | 0 | 1 |
| **CO2** | 0 | 0 | 2 | 0 | 0 | 2 | 2 | 3 | 0 | 1 | 0 | 2 |
| **CO3** | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 3 | 0 | 2 | 0 | 1 |
| **CO4** | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 3 | 0 | 2 | 0 | 1 |
| **CO5** | 0 | 0 | 2 | 0 | 0 | 2 | 2 | 3 | 0 | 1 | 0 | 1 |

**Course Content:**

**UNIT - I**

**Professional Ethics and Human values:**

Ethics -History of Ethics-Types of Ethics, Professional Ethics and its forms - Morals, Values – Integrity – Civic Virtue –Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time – Co-operation – Loyalty- Collegiality-Commitment – Empathy – Self-confidence – Spirituality- Character.

**UNIT - II**

**Engineering & Organization Ethics:**

Engineering Ethics-Meaning & Purpose of Engineering Ethics- Consensus and Controversy –Work Place Ethics and Business Ethics –Ethics in HRM, Finance & Marketing – Ethical Theories-Meaning & Uses of Ethical Theories-Theories of moral Development-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

**UNIT - III**

**Engineers Responsibilities and Rights:**

Key Characteristics of Engineering Professionals – Professional Roles to be played by an Engineer - Ethical egoism-Collective bargaining-Confidentiality- Acceptance of Bribes/Gifts when is a Gift and a Bribe-

examples of Gifts v/s Bribes-Whistle Blowing and its types-when should it be attempted-preventing whistle blowing.

**UNIT - IV**

**Engineers' Responsibility for Safety and Risk:**

Concept of Safety-Types of Safety, Risk-Types of Risks, Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

**UNIT - V**

**Ethical issues in Social Media:**

Social Media- Various Social Media Platforms: Google, Facebook, YouTube, Instagram -Social Media set-up and Uses-Ethical use of Social media-Effects of Social Media on Public- Social Media (vs) News- Social Media Fame and Reputation-Trolling, Harassing, and Hating on Social Media-Legal Aspects of Social Media.

**REFERENCES :**

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar- PHI Learning Pvt. Ltd-2009.
2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana- Maruthi Publications.
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications
4. "Professional Ethics and Human Values" by Prof.D.R.Kiran-
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger -Tata McGraw- Hill -2003
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

**Web Resources:**

1. https://study.com/academy/lesson/ethical-issues-in-internet-social-media-marketing.html

2. https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_rights_of_engineers

3. https://link.springer.com/article/10.1007/s11948-997-0039-x

# II B.Tech. –II Semester

## STRENGTH OF MATERIALS – II

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4T06 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Engineering Mechanics & Strength of Materials– I | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. |

| | |
|---|---|
| **2** | To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs. |
| **3** | To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure |
| **4** | To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions |
| **5** | To calculate combined effect of direct and bending stresses on different engineering structures |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Relate to principal stresses, strains under various loading conditions. (K2) |
| **CO2** | Understand the concept of torsion in circular shafts. (K2) |
| **CO3** | Determine hoops stress and radial stress cylinders and spherical shells. (K3) |
| **CO4** | Analyze columns and struts under different loading conditions with different end conditions. (K4) |
| **CO5** | Analyze direct and bending stresses in dams, retaining walls and chimneys. (K4) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| **CO2** | 3 | 3 | 2 | -- | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| **CO3** | 3 | 3 | 2 | 1 | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| **CO4** | 3 | 3 | 2 | -- | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | -- |
| **CO5** | 3 | 3 | 2 | 1 | -- | 1 | -- | -- | -- | 1 | -- | 2 | -- | 2 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **PRINCIPAL STRESSES AND STRAINS AND THEORY OF FAILURES:** Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses Accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions. |
| **UNIT II** | **TORSION OF CIRCULAR SHAFTS AND SPRINGS:** Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\phi/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.<br>**SPRINGS:** Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs |

| | |
|---|---|
| **UNIT III** | **CYLINIDERS AND SPHERICAL SHELLS**<br>**THIN CYLINDERS AND SPHERICAL SHELLS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders – Thin spherical shells.<br>**THICK CYLINDERS AND SPHERICAL SHELLS:** Introduction Lame's theory for thick cylinders –Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells. Introduction to Unsymmetrical Bending |
| **UNIT IV** | **COLUMNS AND STRUTS:** Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula. Laterally loaded struts – subjected to uniformly distributed and concentrated loads – Maximum B.M. and stress due to transverse and lateral loading. Columns with Initial Curvatures |
| **UNIT V** | **DIRECT AND BENDING STRESSES:** Stresses under the combined action of direct loading and B.M. Core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axis. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Mechanics of Materials- by R. C. Hibbler |
| **2.** | Strength of materials by R.K.Bansal |
| **REFERENCE BOOKS** | |
| **1.** | Fundamentals of Solid Mechanics M.L. Gambhir, PHI Learning Pvt. Ltd., New Delhi |
| **2.** | Introduction to text book of Strength of Material by U.C. Jindal, Galgotia publications. |
| **3.** | Strength of materials by S.S. Bhavakatti |
| **WEB RESOURCES** | |
| **1.** | www.nptel.ac.in/courses |
| **2.** | https://theconstructor.org/ |

## CONCRETE TECHNOLOGY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4T07 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Construction Materials | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To understand the properties of ingredients of concrete |
| **2** | To know about the procedures in concreting and study the behavior of concrete at its fresh state |

| | |
|---|---|
| **3** | To study the behavior of concrete at its hardened stage |
| **4** | To study about the concrete design mix |
| **5** | To understand special concrete and their use |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Know the basic concept of concrete and its ingredients. (K1) |
| **CO2** | Perceive the importance of quality of concrete.(K2) |
| **CO3** | Know the properties of hardened concrete. (K1) |
| **CO4** | Design the concrete mix by BIS method. (K4) |
| **CO5** | Understand the Basic concept of special concrete and their production. (K2) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | -- | 2 | -- | 1 | 1 | -- | -- | -- | -- | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 1 | -- | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | 2 | 2 | 3 |
| **CO3** | 3 | 1 | 1 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | 2 | 3 | 2 |
| **CO4** | 3 | 1 | 3 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | 3 | 2 | 3 |
| **CO5** | 3 | -- | 1 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | 3 | 2 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **INGREDIENTS OF CONCRETE**<br>**CEMENTS & ADMIXTURES:** Types of Cement – Grades of Cement - Chemical composition - Tests of Cement– Hydration - Structure of hydrated cement – Mineral and Chemical Admixtures – accelerators, retarders, air-entrainers, plasticizers, super plasticizers, fly ash and silica fume.<br>**AGGREGATES:** Classification of aggregate – Particle shape & texture – Mechanical properties of aggregates – Tests of Aggregates - Alkali aggregate reaction – Thermal properties – Grading curves – Grading of fine & coarse Aggregates – Gap graded and |

| | |
|---|---|
| | well graded aggregate as per relevant IS code – Quality of mixing water. |
| **UNIT II** | **FRESH CONCRETE:** Manufacture of Concrete – Properties of fresh concrete - Workability –Factors affecting workability – Measurement of workability by different tests, Effect of time and temperature on workability Segregation & bleeding |
| **UNIT III** | **HARDENED CONCRETE:** Water / Cement ratio – Abram's Law – Gel space ratio – Nature of strength of concrete –Maturity concept – Factors affecting strength - Relation between compressive & tensile strength – Testing of Hardened Concrete – Types of Non-destructive testing.<br>**ELASTICITY, CREEP & SHRINKAGE** – Modulus of elasticity –Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Shrinkage – types of shrinkage. |
| **UNIT IV** | **MIX DESIGN:** Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Concepts Proportioning of concrete mixes by various methods – BIS method of mix design. |
| **UNIT V** | **SPECIAL CONCRETES:** Ready mixed concrete, Shotcrete -Light weight aggregate concrete – Cellular concrete – No-fines concrete, High density concrete, Fibre reinforced concrete – Factors affecting properties of F.R.C - Polymer concrete – Properties of polymer concrete, High performance concrete – Self Compaction Concrete - SIFCON - self healing concrete. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Properties of Concrete by A. M. Neville – PEARSON – 4th edition. |
| **2.** | Concrete Technology by M. L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi. |
| **3.** | Concrete Technology by A.M.Neville.-Pearson Publishers |
| **REFERENCE BOOKS** | |
| **1.** | Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi |
| **2.** | Concrete Technology by M. S. Shetty. – S. Chand & Co.; 2004. |
| **WEB RESOURCES** | |
| **1.** | http://freevideolectures.com/Course/3357/Concrete-Technology |
| **2.** | https://nptel.ac.in/courses/105102012/ |

## ENGINEERING GEOLOGY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4T08 |
| **Course Type** | Theory | **L-T-P-C** | 3-0–0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the Engineering Geology as a subject in Civil Engineering. |
| **2** | To identify and know the varieties of minerals and rocks and their importance. |

| | |
|---|---|
| **3** | To know the variance of Geological structures below the earth. |
| **4** | To identify the seismic hazards posed at any given site. |
| **5** | To know the different Civil Engineering structures and their construction. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Introduce the subject and give a brief explanation to Civil Engineering importance of weathering. (K2) |
| **CO2** | Observe and Identify the properties of rocks and minerals and to impart a brief importance in the point of identification. (K2) |
| **CO3** | Know a brief knowledge About Recognize of various structures of rock and to identify the differences between the geology and geophysics. (K1) |
| **CO4** | Classify and measure the earthquake prone areas to practice the hazard Zone. (K4) |
| **CO5** | Locate a suitable site for the construction of Civil engineering structures. (K3) |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 1 | 1 | 1 | 2 | 2 | 2 | 3 | -- | -- | 2 | 2 | -- | -- | -- | -- |
| **CO2** | 2 | 1 | 1 | 3 | 2 | 2 | 1 | -- | -- | 2 | 3 | -- | -- | -- | -- |
| **CO3** | 1 | 1 | 1 | 2 | 3 | 3 | 2 | -- | -- | 2 | 3 | -- | -- | -- | -- |
| **CO4** | 3 | 1 | 1 | 3 | 2 | 3 | 2 | -- | -- | 2 | 3 | -- | -- | -- | -- |
| **CO5** | 1 | 1 | 1 | 2 | 3 | 3 | 2 | -- | -- | 2 | 3 | -- | -- | -- | -- |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies.<br>Weathering: Weathering of rocks, Geological agents, weathering process of Rock, Factors affecting weathering types of weathering agents River process and their development. Landforms: produced by rivers. Erosion and Denudation |
| **UNIT II** | Mineralogy And Petrology: Definitions of mineral and rock, Different methods of study on minerals and rocks, The study of physical properties of minerals and rocks for Macroscopic study for the Common rock forming minerals and other ore forming minerals. Classification structures, textures and forms of Igneous rocks Sedimentary |

| | |
|---|---|
| | rocks, Metamorphic rocks and their study. |
| **UNIT III** | Structural Geology: a)Strike , Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults,<br>Joints and Unconformities- parts types, Mechanism and their importance in Civil Engineering structural Geology Strength Comparisons of Igneous Sedimentary and metamorphic rock structures. |
| **UNIT IV** | Ground Water: Water table Cone of depression Geological controls of Ground Water Movement, Ground Water Exploration Techniques. Types of Aquifers- porosity and permeability and water bearing properties of rocks.<br>Earthquakes And Landslides: Terminology, Classification, causes and effects, Shield areas and Seismic belts Richter scale intensity Precautions of building constructions in seismic areas. Seismic Zones in India Classification of Landslides Causes and Effects measures to be taken prevent their occurrence at Landslides. |
| **UNIT V** | Dams: Types and purpose of Dams, Geological considerations in the selection of a Dam, Remedial measures to be taken to select the dam site.<br>Reservoirs: Factors responsible in the selection of Reservoir site, Life of Reservoirs.<br>Tunnels: Purpose of Tunneling, Effects, Lining of Tunnels. Influence of Geology for successful Tunneling. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Engineering Geology' by Subinoy Gangopadhay, Oxford University press. |
| **2.** | Engineering Geology' by N. Chenna Kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014. |
| **REFERENCE BOOKS** | |
| **1.** | 'Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd. |
| **2.** | Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3rd edition. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/105105106/1 |

## HYDRAULICS & HYDRAULIC MACHINERY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4T09 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Fluid mechanics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To get exposure about the applications of Hydraulic Engineering in the field by means of studying the various channels. |

| | |
|---|---|
| **2** | To learn applications of dimensional analysis |
| **3** | To study the effect of impact of jet of water on vanes. |
| **4** | To study the suitability of usage of turbines |
| **5** | To learn about usage of various pumps |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | To study theories those explain the behavior and performance of fluid when the fluid is flowing in an Uniform open channel and non-uniform channels. (K1) |
| **CO2** | Student will attain the knowledge on hydraulic similitude of fluids. (K2) |
| **CO3** | Student will get acquainted with the concept of impact of jets. (K2) |
| **CO4** | To understand the components, function and use of different types of turbines. (K2) |
| **CO5** | To understand the components, function and use of different types of pumps. (K2) |

**Contribution of Course Outcomes towards achievement of Program**

**Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- | 2 |
| CO2 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- | 2 |
| CO3 | 2 | 3 | 2 | 1 | 1 | -- | -- | -- | -- | -- | -- | 2 | -- | -- | 1 |
| CO4 | 2 | 2 | 2 | 1 | - | 1 | 1 | 1 | -- | -- | -- | 2 | -- | -- | 1 |
| CO5 | 2 | 2 | 2 | 3 | 1 | 1 | 1 | -- | -- | -- | -- | 2 | -- | -- | 1 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **OPEN CHANNEL FLOW:** Types of flows - Type of channels – Velocity distribution – Energy and momentum correction factors – Chezy's, Manning's; Kutter's Equations; and Bazin formulae for uniform flow – Most Economical sections. Critical flow: Specific energy-critical depth – computation of critical depth –critical sub-critical and super critical flow . |
| **UNIT II** | **HYDRAULIC SIMILITUDE:** Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations |
| **UNIT III** | **BASICS OF TURBO MACHINERY:** Hydrodynamic force of jets on stationary and moving flat inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.<br>**HYDRO ELECTRIC POWER PLANT :** Layout of a typical Hydropower installation – Heads and efficiencies - classification of turbines |
| **UNIT IV** | **HYDRAULIC TURBINES :** Pelton wheel - Francis turbine – Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency Draft tube-theory & function efficiency, Governing of turbines-surge tanks-unit and specific turbines-unit speed-unit quantity-unit power-specific speed performance characteristics-geometric similarity-cavitation |

| | |
|---|---|
| **UNIT V** | **CENTRIFUGAL PUMPS:** Pump installation details-classification-work done- Manometric head-minimum starting speed-losses and efficiencies, specific speed, multistage pumps-pumps in parallel- performance of pumps Similarity Considerations. Characteristic curves - NPSH- Cavitations.<br>**RECIPROCATING PUMPS:** Introduction, classification of reciprocating pumps, main components of reciprocating pumps, working of a reciprocating pumps, discharge through pumps, indicator diagram, work done by reciprocating pumps, slip of reciprocating pumps |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Fluid Mechanics, Thermodynamics of Turbomachinery by S.L. Dixon |
| **2.** | Hydraulics & Fluid Mechanics by P. N. Modi & S. N. Seth; Standard Book house, New Delhi |
| **REFERENCE BOOKS** | |
| **1.** | Hydraulic Machines by Jagadhishlal; Metropoliton Company, Delhi. |
| **2.** | Fluid Mechanics & Hydraulic Machines by Dr. R. K. Bansal; Laxmi Publications, New Delhi. |
| **3.** | Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi |
| **WEB RESOURCES** | |
| 1. | www.nptel.ac.in/courses |
| **2.** | https://theconstructor.org/ |

## HIGHWAY ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4T10 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Construction Materials | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the students with the principles and practice of transportation engineering which focuses on Highway Engineering. |
| **2** | To provide basic knowledge on materials used in pavement construction. |

| | |
|---|---|
| **3** | Ability to mathematically develop and interpret design standards for horizontal and vertical geometry and superelevation |
| **4** | To enable the students to have a strong analytical and practical knowledge of Planning, Designing of Pavements. |
| **5** | To provide basic knowledge in traffic engineering, and transportation planning. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Plan highway network for a given area. (K3) |
| **CO2** | Characterize the pavement materials like aggregates, Bituminous materials &construction. (K2) |
| **CO3** | Design the Highway geometrics based on highway alignment. (K3) |
| **CO4** | Judge suitability of pavement materials and design flexible and rigid pavements. (K2) |
| **CO5** | Design Intersections and prepare traffic management plans. (K4) |

**Contribution of Course Outcomes towards achievement of Program**

**Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 1 | -- | 1 | | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 1 | 3 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 1 | 2 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Highway Planning and Alignment:** Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports. |
| **UNIT II** | **Highway Materials:** Sub-grade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties -Tests on Bitumen |
| **UNIT III** | **Highway Geometric Design:** Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, |

| | |
|---|---|
| | Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves. |
| **UNIT IV** | **Design of Pavements:** Types of pavements; Functions and requirements of different components of pavements; Design Factors<br>**Flexible Pavements:** Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements.<br>**Rigid Pavements:** Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements. |
| **UNIT V** | **Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC method. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Highway Engineering' by Paul H. Wright and Karen K Dixon, Wiley Student Edition, Wiley India (P) Ltd., New Delhi. |
| **2.** | Highway Engineering' by Khanna S.K., Justo C.E.G and Veeraragavan A, Nem Chand Bros, Roorkee. |
| **REFERENCE BOOK** | |
| **1.** | Transportation Engineering and Planning' by Papacostas C.S. and PD Prevedouros, Prentice Hall of India Pvt. Ltd; New Delhi. |
| **2.** | 'Highway Engineering' by Srinivasa Kumar R, Universities Press, Hyderabad |
| **WEB REFRENCES** | |
| **1.** | https://nptel.ac.in/downloads/105101087/ |

## STRUCTURAL ANALYSIS-I

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4T11 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Engineering Mechanics & Strength of Materials-I | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To give preliminary concepts of assessments of bending moment and shear force in propped cantilevers. |
| **2** | To impart concepts of shear force and bending moment for Fixed Beams. |

| | |
|---|---|
| **3** | To give preliminary concepts of assessments of bending moment and shear force in Continuous beams |
| **4** | The procedure for development of slope deflection equations for continuous beams with and without support settlement. |
| **5** | To impart basic knowledge on strain energy in the application of beams and frames. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Analyze the bending moment and shear force for propped cantilever beam at different loading and boundary conditions. (K4) |
| **CO2** | Determine the bending moment, shear force and deflection for Fixed beams with different loading and boundary conditions. (K4) |
| **CO3** | Analyze the continuous beams by using Clapeyron's theorem at different support conditions. (K4) |
| **CO4** | Analyze the continuous beams by using Slope Deflection Method. (K4) |
| **CO5** | Determinate the deflections by applying the energy theorems. (K4) |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | - | 1 | - | - | 2 | - | - | 2 | 1 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 2 | - | 1 | - | - | 2 | - | - | 2 | 1 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | - | 1 | - | - | 2 | - | - | 2 | 1 | 3 | 1 |
| CO4 | 3 | 3 | 2 | 2 | - | 2 | - | - | 3 | - | - | 2 | 2 | 3 | 1 |
| CO5 | 3 | 3 | 3 | 2 | - | 2 | - | - | 3 | - | - | 2 | 2 | 3 | 1 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **PROPPED CANTILEVERS:** Analysis of propped cantilevers-shear force and bending moment diagrams-Deflection of propped cantilevers. |
| **UNIT II** | FIXED BEAMS: Introduction to statically indeterminate beams with udl, central point load, eccentric point load, Number of point loads, uniformly varying load, couple and combination of loads shear force and bending moment diagrams-Deflection of fixed beams effect of sinking of support, effect of rotation of a support. |
| **UNIT III** | CONTINUOUS BEAMS: Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed.<br>Continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams. |

| | |
|---|---|
| **UNIT IV** | SLOPE-DEFLECTION METHOD: Introduction, derivation of slope-deflection equation, application to continuous beams with and without settlement of supports. |
| **UNIT V** | **ENERGY THEOREMS:** Introduction to Strain energy, Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castiglianos first theorem - Deflections of simple beams and pin jointed trusses. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Structural Analysis by V.D. Prasad Galgotia publications, 2nd Editions. |
| **2.** | Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | Theory of Structures by Gupta, Pandit & Gupta; Tata McGraw Hill, New Delhi. |
| **2.** | Theory of Structures by R.S. Khurmi, S. Chand Publishers. |
| **3.** | C. S. Reddy, Basic Structural Analysis, Tata McGraw Hill |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/105105166/ |
| **2.** | https://cosmolearning.org/courses/structural-analysis-video-lessons/video-lectures/ |
| **3.** | http://www.nptelvideos.in/2012/11/structural-analysis-ii.html |

## FLUID MECHANICS & HYDRAULIC MACHINERY LAB

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4L03 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To know the knowledge of various flow meters and the concept of fluid mechanics. Students will compare the performance of various machines at different operating points. |
| **2** | To understand the flow through different channels in Practical conditions |
| **3** | Useful to learn the Bernoulli's Equation Practical Applications. |
| **4** | Can understand the different hydraulic turbines in power plants. |

| | |
|---|---|
| **5** | This lab helps to gain knowledge on working of centrifugal pumps, positive displacement pumps. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Perform experiments to determine the coefficient of discharge of flow measuring devices. (K2) |
| **CO2** | Analyze the flow through rectangular and v-notch and pipe flow losses. (K4) |
| **CO3** | Verify the Bernoulli's theorem and knowledge on impact of jets. (K2) |
| **CO4** | Conduct experiments on hydraulic turbines and pumps to draw characteristics. (K2) |
| **CO5** | Examine the centrifugal and reciprocating pumps. (K2) |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 2 | 2 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | 3 | 1 |
| **CO2** | 3 | 2 | 2 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | 3 | 1 |
| **CO3** | 3 | 2 | 2 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | 3 | 1 |
| **CO4** | 3 | 2 | 2 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | 3 | 1 |
| **CO5** | 3 | 2 | 2 | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 1 | 3 | 1 |

| S No | **List of Experiments** |
|---|---|
| 1 | Calibration of Venturimeter & Orifice meter |
| 2 | Determination of Coefficient of discharge for a small orifice by a constant head method. |
| 3 | Determination of Coefficient of discharge for an external mouth piece by variable head method. |
| 4 | Calibration of contracted Rectangular Notch and /or Triangular Notch |
| 5 | Determination of Coefficient of loss of head in a sudden contraction and friction factor. |
| 6 | Verification of Bernoulli's equation. |
| 7 | Impact of jet on vanes |
| 8 | Study of Hydraulic jump. |
| 9 | Performance test on Pelton wheel turbine |
| 10 | Performance test on Francis turbine. |
| 11 | Efficiency test on centrifugal pump. |

| | |
|---|---|
| 12 | Efficiency test on reciprocating pump. |

| S No | List of Equipments. |
|---|---|
| 1 | Venturimeter setup. |
| 2 | Orifice meter setup. |
| 3 | Small orifice setup. |
| 4 | External mouthpiece setup. |
| 5 | Rectangular and Triangular notch setups |
| 6 | Friction factor test setup. |
| 7 | Bernoulli's theorem setup |
| 8 | Impact of jets. |
| 9 | Hydraulic jump test setup |
| 10 | Pelton wheel and Francis turbines. |
| 11 | Centrifugal and Reciprocating pumps |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Fluid Mechanics and Hydraulic Machines by R. K. Bansal; Laxmi Publications; New Delhi. |
| **2.** | Hydraulics & Fluid Mechanics by P. N. Modi & S. N. Seth; Standard Book house, New Delhi |
| **REFERENCE BOOKS** | |
| **1.** | Rajput R.K., Fluid Mechanics and Hydraulic Machines, S.Chand and Company Ltd., 2005. |
| **WEB RESOURCES** | |
| **1.** | http://www.nptelvideos.in/2012/11/fluid-mechanics.html |
| **2.** | https://nptel.ac.in/courses/105101001/ |

## Engineering Geology Laboratory

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE4L04 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | ---- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 40<br>60<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Sedimentary processes (Weathering, erosion, deposition), Metamorphism and volcanic eruptions. |
| **2** | Identification of the minerals types of clay minerals their properties and effects on engineering project |
| **3** | Types of rock (Igneous, Sedimentary, and Metamorphic), Civil engineering importance of |

| | |
|---|---|
| | rock forming minerals |
| **4** | Geological structures (Joint, veins, crack, faults, and fold), reasons of formation for each type and their side effects on the engineering projects |
| **5** | Origin, Internal and surface structures of the earth |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Identify the minerals and their properties.[K3] |
| **CO2** | Recognize the rocks and their properties.[K3] |
| **CO3** | Determine the behavior of the bedding planes in terms of solving strike and dip.[K5] |
| **CO4** | Draw sections for geological maps showing tilted beds and faults.[K6] |
| **CO5** | Identify the morphological and geological characteristics on maps.[K3] |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | -- | -- | 1 | -- | -- | -- | -- | 3 | -- | -- | 2 | 3 | -- | 2 |
| **CO2** | 3 | 3 | 1 | 2 | -- | -- | -- | -- | 2 | -- | -- | 2 | 3 | -- | 2 |
| **CO3** | 3 | -- | -- | 2 | -- | -- | -- | -- | 3 | -- | -- | -- | 2 | -- | 3 |
| **CO4** | 3 | 3 | 1 | 3 | 3 | -- | -- | -- | 3 | -- | -- | 2 | 3 | -- | 3 |
| **CO5** | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | 3 | 2 | 3 |

**COURSE CONTENT**

| **S.No** | **List of Experiments** |
|---|---|
| **1.** | Physical properties of minerals: Mega-scopic identification of |
| **2.** | Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc… |
| **3.** | Ore forming minerals **–** Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite. |
| **4.** | Megascopic description and identification of rocks. |
| **5.** | Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc |
| **6.** | Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc. |
| **7.** | Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite &Biotiteschist, Marble, Khondalite, etc |
| **8.** | Interpretation and drawing of sections for geological maps showing tilted beds, faults, |

| | |
|---|---|
| | unconformities etc |
| **9.** | Simple Structural Geology problems. |
| **10.** | Bore hole data |
| **11.** | Strength of the rock using laboratory tests. |
| **12.** | Field work – To identify Minerals, Rocks, Geomorphology& Structural Geology. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Engineering Geology' by SubinoyGangopadhay, Oxford University press |
| **2.** | Engineering Geology' by N. ChennaKesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014. |
| **REFERENCE BOOKS** | |
| **1.** | Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd. |
| **2.** | Fundamentals of Engineering Geology' by P.G. Bell, B.S.P. Publications, 2012. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/105105106/ |

**Essence of Indian Traditional Knowledge**
(Common to all branches) Code:19HM4T06

| | | | |
|---|---|---|---|
| **Course Category** | Humanities including Management | **Credits** | 0 |
| **Course Type** | Theory | **Lecture-Tutorial-Practice** | 2 -0 -0 |
| **Prerequisites** | | Total Marks (Internal Assessment) | 100 |

| **Course Outcomes** | | **Blooms Taxonomy Level** |
|---|---|---|
| **On successful completion of the course, the student will be able to** | | |
| **CO 1** | Understand the significance of Indian Traditional Knowledge. | Understanding |
| **CO 2** | Classify the Indian Traditional Knowledge | Analysis |

| | | |
|---|---|---|
| **CO 3** | Compare Modern Science with Indian Traditional Knowledge system. | Evaluating |
| **CO 4** | Analyze the role of Government in protecting the Traditional Knowledge | Analysis |
| **CO 5** | Understand the impact of Philosophical tradition on Indian Knowledge System. | Understanding |

| **Contribution of Course Outcomes towards achievement of Program** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Outcomes: 1 – Low, 2 - Medium, 3 – High | | | | | | | | | | | |
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** |
| **CO1** | 0 | 1 | 2 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 0 | 0 |
| **CO2** | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 1 | 1 | 2 | 2 | 1 |
| **CO4** | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| **CO5** | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 3 | 0 | 1 |

**Course Content :**

**Unit I**

**Introduction to Traditional Knowledge**: Define Traditional Knowledge- Nature and Characteristics-Scope and Importance- kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in global economy.

**Unit II**

**Basic structure of Indian Knowledge System**: Astadash Vidya- 4 Ved - 4 Upaved (Ayurved,Dhanurved,GandharvaVed&SthapthyaAdi),6vedanga(Shisha,Kalppa,Nirukha,Vykaran,Jyothisha&Chand),4upanga(Dharmashastra,Meemamsa,purana&Tharka Shastra).

**Unit III**

**Modern Science and Indian Knowledge System**-Indigenous Knowledge, Characteristics- Yoga and Holistic Health care-cases studies.

**Unit IV**

**Protection of Traditional Knowledge**: The need for protecting traditional knowledge -Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge.

**Unit V**

**Impact of Traditions:** Philosophical Tradition (Sarvadarshan)
Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka,
Jain & Boudh - Indian Artistic Tradition - Chitra kala, Moorthikala,
Vasthu kala , Sthapthya, Sangeetha, Nruthya Yevam Sahithya

**Reference Books** :

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta andVipin Kumar Singh, Pratibha Prakashan 2012.
3. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Pramod Chandra, India Arts, Howard Univ. Press, 1983.
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

**Web Resources:**

1. https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html

2. http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf

3.https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

# ESTIMATION, SPECIFICATIONS AND CONTRACTS

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE5T12 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Building Planning & drawing | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Understand the quantity calculations of different components of the buildings. |
| **2** | Understand the rate analysis of different quantities of the buildings components. |
| **3** | Learn various specifications and components of the buildings. |
| **4** | To study estimation of buildings including R.C.C. members. |
| **5** | To study rate analysis. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain the basic concept of quantity estimation for building, roads, canals and hydraulic structures by manual and software packages. |
| **CO2** | Calculate rate analysis and man-hours required for the common civil works by manual and software packages. |
| **CO3** | Develop the specification for the materials used in construction and preparing reports |
| **CO4** | Develop construction contracts and contract document preparation. |
| **CO5** | Identify the valuation for building, land and plant and machineries, calculation of rent, mortgage and lease. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 1 | 1 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **QUANTITY ESTIMATION:**<br>Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates Detailed estimate – Estimation of quantities for buildings, roads, canals and hydraulic structures using computer software's. |
| **UNIT-II** | **RATE ANALYSIS AND COSTING:**<br>Standard Data – Observed Data – Schedule of rates – Market rates – Assessment of Man Hours and Machineries for common civil works – Rate Analysis – Cost Estimates using Computer software's. |
| **UNIT-III** | **SPECIFICATIONS, REPORTS AND TENDERS:**<br>Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – Report on estimate of residential building Culvert – Roads - TTT Act 2000 – Tender notices – Types – Tender procedures – Drafting model tenders , E-tendering- Digital signature certificates- Encrypting -Decrypting – Reverse auctions. |
| **UNIT-IV** | **CONTRACTS:**<br>Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, Material, Design, Construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements. |
| **UNIT-V** | **VALUATION:**<br>Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings Valuation of plant and machineries - Calculation of Standard rent – Mortgage – Lease. |

| TEXT BOOKS | |
|---|---|
| **1.** | B.N Dutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010. |
| **2.** | B.S. Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006. |
| **REFERENCE BOOKS** | |
| **1.** | Standard Data book for analysis and rates. |
| **2.** | Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April 1996. |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Dr. P. Subba Rao** | **Dr. D. Rama Seshu** | **Dr. D. S Murthy** | **Mr. M. Sandeep** | **Mr. V. Manideep** | **Mr. A. Raviteja** | **Mr. A. Roger Antony** |

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

# DESIGN & DETAILING OF REINFORCED CONCRETE STRUCTURES

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE5T13 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Concrete Technology& Strength of materials. | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The student can gain the knowledge about the behavior of reinforced concrete elements and load transferring system. |
| **2** | Familiarize students with different types of design philosophies and with concepts of design of flexural members. |
| **3** | Understand the concepts of Shear, Torsion and Bond. |
| **4** | Familiarize students with different types of Compression members and their Designs. Understand different types of footings and their Design. |
| **5** | Familiarize students with different types of Slabs and their Designs. To gain knowledge about different types of loads on structures and different codes of practice. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Identify the methods which are suitable for particular structures. |
| **CO2** | Carryout analysis and design of flexural members and detailing. |
| **CO3** | Decipher concepts of Shear, Torsion and Bond. |
| **CO4** | Design the Short and Long columns with desirable loading conditions. Determine the dimensions of the footing with desirable loading conditions. |
| **CO5** | Design the Slabs with desirable loading conditions. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO2** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO3** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO4** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO5** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **INTRODUCTION:** Working stress method design codes and handbooks, Loading standards – Dead, live, wind and earthquake loads, Elastic theory, Design constants, Modular ratio, Neutral axis depth and Moment of resistance, Balanced, Under-reinforced and Over-reinforced sections, Working stress method of design for singly and doubly reinforced beams.<br>**LIMIT STATE DESIGN**: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – Representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – Stress-block parameters – limiting moment of Resistance. |
| **UNIT-II** | **DESIGN FOR FLEXURE:** Limit state analysis and design for singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced beams - Flanged (T and L) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement-Maximum Flexural Steel- Design of Flanged Sections (T&L)- Effective width of flange –Behaviour- Analysis and Design. |
| **UNIT-III** | **DESIGN FOR SHEAR, TORSION AND BOND:** Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.<br>**LIMIT STATE DESIGN FOR SERVICEABILITY:** Deflection, cracking and code provision, Design of formwork for beams and slabs. |
| **UNIT-IV** | **DESIGN OF COMPRESSION MEMBERS:** Effective length of a column, Design of short and long columns – under axial loads, Uni-axial bending and biaxial bending – Braced and Un-braced columns – I S Code provisions.<br>**FOOTINGS:** Different types of footings – Design of isolated and combined footings - rectangular and circular footings subjected to axial loads, Uni-axial and bi-axial bending moments. |
| **UNIT-V** | **SLABS:** Classification of slabs, Design of one - way slabs, two - way slabs and continuous slabs using IS Coefficients (conventional), Design of waist-slab staircase. |

**NOTE:** All the designs should teach in Limit State Method. Following plates should be prepared by the students.

1. Reinforcement particulars of T-beams and L-beams.
2. Reinforcement detailing of Continuous beams.
3. Reinforcement particulars of Columns and Footings.
4. Detailing of One way, Two way and Continuous slabs.

## INTERNAL EXAMINATION PATTERN:

The total internal marks (40) are distributed in two components as follows:

1. Descriptive (subjective type) examination: 30marks.

2. Assignment: 10marks

## FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Detailing, out of which one question is to be answered. Part B should consist of five questions and out of which three questions to be answered. Weightage for Part – A is 40% and Part- B is 60%.

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Limit State Design by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi. |
| **2.** | Reinforced concrete design by S. Unnikrishna Pillai & Devdas Menon, TataMc.Graw Hill, NewDelhi. |
| **REFERENCE BOOKS** | |
| **1.** | Fundamentals of Reinforced concrete design by M.L. Gambhir, Printice Hall of India Private Ltd., NewDelhi. |
| **2.** | Reinforced concrete structural elements – behaviour, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994. |
| **3.** | Design of concrete structures – Arthus H.Nilson, David Darwin, and Chorles W. Dolar, Tata Mc.Graw-Hill,3rd Edition,2005. |
| **4.** | Reinforced concrete structures, Vol.1, by B.C.Punmia, Ashok Kumar Jain andArun Kumar Jain, Laxmi, publications Pvt.Ltd., NewDelhi. |
| **5.** | Reinforced concrete structures – I.C. Syal&A.K.Goel, S.ChandPublishers. |
| **6.** | Limit state designed of reinforced concrete – P.C.Varghese, Printice Hall ofIndia, New Delhi. |
| **7.** | Fundamentals of reinforced concrete by N.C. Sinha and S.K Roy, S. Chandpublishers. |
| **8.** | Reinforced concrete design by N. Krishna Raju and R.N. Pranesh, Newage International Publishres, New Delhi. |
| **WEB REFERENCES** | |
| **1.** | http://freevideolectures.com/Course/2686/Design-of-Reinforced-Concrete-Structures |

## IS Codes:

1. IS-456-2000 (Permitted to use in examination hall)
2. IS-875 part (I, II, III,IV)
3. SP-16 (Permitted to use in examination hall)

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|---|---|---|---|---|---|---|
| **Dr. P. Subba Rao** | **Dr. D. Rama Seshu** | **Dr. D. S Murthy** | **Mr. M. Sandeep** | **Mr. V. Manideep** | **Mr. A. Raviteja** | **Mr. A. Roger Antony** |

# GEOTECHNICAL ENGINEERING -I

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE5T14 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Engineering Mechanics. | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To enable the knowledge in formation of soil, notations and their relationships. |
| **2** | To understand the classification of soil and their properties. |
| **3** | To enable the concepts of effective stresses and compaction of soils. |
| **4** | To enunciate the concept of permeability and seepage through soils for better understanding the discharge through different types of soils. |
| **5** | To understand the distribution of stresses in soils and their methods. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Define the formation of soil, notations and their relationships. |
| **CO2** | Compute and Analyze different classifications and properties of soil. |
| **CO3** | Determine the effective stresses in the soil and compaction parameters of soils. |
| **CO4** | Determine the permeability and seepage analysis of the soil. |
| **CO5** | Determine the stress distribution in soils under different loading conditions. |

**Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 2 | 3 |
| **CO4** | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **BASIC DEFINITIONS AND RELATIONSHIPS:**<br>Definition of soil - soil mechanics - soil engineering and geotechnical engineering, scope of soil engineering, origin of soils, formation of soils-clay mineralogy, transportation of soils, |

| | |
|---|---|
| | phase diagram- volumetric relationship, volume mass relation, volume - weight relationship, water content determination, specific gravity of soil solids determination - Field density determination. |
| **UNIT-II** | **INDEX PROPERTIES AND CLASSIFICATION OF SOIL:**<br>Sieve analysis - sedimentation analysis, particle size distribution curve, relative density, plasticity characteristic of soil - consistency limits - consistency indices, particle size classification - Unified, AASHTO, IS classification. |
| **UNIT-III** | **EFFECTIVE STRESS:**<br>Effective stress principles - Spring analogy model - Effect of water table fluctuations on effective stresses under different conditions - Seepage pressure, quick sand condition, failures of hydraulics structures by piping and their preventive measures.<br>**COMPACTION:**<br>Introduction to compaction, Factors affecting compaction, Effect of compaction on properties of soil, Methods of compaction – laboratory and field tests, Relative compaction, Suitability of various methods of compaction. |
| **UNIT-IV** | **PERMEABILITY AND SEEPAGE ANALYSIS:**<br>Capillary phenomena – Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement, pumping out aquifers – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – flow nets – Seepage analysis for sheet pile and weir. |
| **UNIT-V** | **STRESS DISTRIBUTION:**<br>Stress distribution in homogeneous and isotropic medium – Boussinesq theory, westergaards theory – (Point load, Line load and udl) isobar, Use of Newmarks influence chart. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | B.M Das, "Principles of Geotechnical Engineering", 7th edition 2013, Cengage Publications. |
| **2.** | Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006. |
| **REFERENCE BOOKS** | |
| **1.** | 'Fundamentals of Soil Mechanics' by D.W.Taylor., Wiley. |
| **2.** | 'An introduction to Geotechnical Engineering' by Holtz and Kovacs; Prentice Hall |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105103097/ |

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|---|---|---|---|---|---|---|
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**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

# STRUCTURAL ANALYSIS - II

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE5T15 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Structural Analysis-I | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Familiarize Students with Different types of Structures. |
| **2** | Equip student with concepts of Arches. |
| **3** | Understand Concepts of lateral Load analysis. |
| **4** | Familiarize Cables and Suspension Bridges. |
| **5** | Understand Analysis methods Moment Distribution, Kani's Method and Matrix methods. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Differentiate Determinate and Indeterminate Structures of Arches. |
| **CO2** | Carryout lateral Load analysis of structures. |
| **CO3** | Analyze Cable and Suspension Bridge structures. |
| **CO4** | Analyze structures by using Moment Distribution Method &Kani's method. |
| **CO5** | Analyze structures by using Matrix Methods. |

**Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2 - Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | -- | 2 | 2 | -- | 2 | -- | -- | -- | 2 | -- | 3 | 2 | 2 |
| **CO2** | -- | 3 | 3 | -- | 2 | -- | 2 | 1 | -- | -- | 1 | 2 | 3 | 2 | 2 |
| **CO3** | 3 | 2 | 1 | -- | -- | 1 | -- | -- | 1 | -- | 1 | -- | 3 | -- | -- |
| **CO4** | -- | 3 | 2 | 2 | -- | 2 | -- | -- | -- | -- | 1 | -- | 3 | -- | -- |
| **CO5** | 3 | 2 | 2 | -- | -- | 2 | -- | -- | -- | -- | 1 | 2 | 3 | -- | -- |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **ARCHES:**<br>Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches - |

| | |
|---|---|
| | Parabolic and circular arches – Settlement and temperature effects -Eddy's theorem. |
| **UNIT-II** | **CABLE STRUCTURES AND SUSPENSION BRIDGES**:<br>Equilibrium of cable – length of cable - anchorage of suspension cables, analysis of cables subjected to concentrated and uniformly distributed loads, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges. |
| **UNIT-III** | **MOMENT DISTRIBUTION METHOD**:<br>Stiffness - distribution and carry over factors –- Analysis of continuous Beams - Plane rigid frames with and without sway – Support settlement - Symmetric frames with symmetric and skew - Symmetric loading. |
| **UNIT-IV** | **FLEXIBLITY METHOD:**<br>Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of Indeterminate pin - jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach. |
| **UNIT-V** | **STIFFNESS METHOD:**<br>Restrained structure – Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | 'Structural Analysis' by T.S. Thandavamoorthy, Oxford university press, India. |
| **2.** | 'Structural Analysis' by R.C. Hibbeler, Pearson Education, India. |
| **REFERENCE BOOKS** | |
| **1.** | 'Theory of structures' by Ramamuratam, Dhanpatrai Publications. |
| **2.** | 'Analysis of structures' by Vazrani & Ratwani – Khanna Publications. |
| **3.** | 'Theory of Structures – II' by B.C. Punmia, Jain & Jain, Laxmi Publications, India. |
| **4.** | 'Structural Analysis' by C.S. Reddy, Tata Mc-Graw hill, New Delhi. |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105101086/ |

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|---|---|---|---|---|---|---|
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## RAILWAYS, AIRPORTS AND SEAPORTS

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE5T16 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Highway Engineering | **Internal Assessment**<br>**Semester End Examination** | 30<br>70 |

| | | | |
|---|---|---|---|
| | | **Total Marks** | 100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To know various components and their functions in a railway track. |
| **2** | To acquire design principles of geometrics in a railway track. |
| **3** | To know various techniques for the effective movement of trains. |
| **4** | To acquire design principles of airport geometrics and pavements. |
| **5** | To know the planning, construction and maintenance of Docks and Harbours. |
| **6** | To know about the fundamental of airways. |
| **7** | To know about the different fundamental components of harbours and docks. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain the various concepts in railway design and components of railway track. |
| **CO2** | Analyze the construction process, maintenance and operation of railway track. |
| **CO3** | List out the various components of airports, planning concepts and air traffic controls. |
| **CO4** | Evaluate the design of airport, cost estimation and geometric design of airports. |
| **CO5** | List out the various terms in harbour engineering and its classification. |

**Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | -- | -- | 1 | 3 | -- | 2 | 1 | 3 | 3 | -- | -- | 1 | -- | 2 | 1 |
| **CO2** | 3 | -- | -- | -- | 3 | -- | 1 | -- | 3 | 2 | -- | -- | 2 | -- | 2 |
| **CO3** | 2 | -- | 1 | -- | 3 | -- | -- | 3 | -- | -- | -- | -- | -- | 3 | -- |
| **CO4** | -- | 2 | -- | 2 | -- | 1 | -- | -- | 3 | -- | 1 | 1 | 2 | -- | -- |
| **CO5** | 1 | -- | 2 | 3 | -- | -- | 1 | -- | 3 | -- | 1 | 1 | -- | -- | 2 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **COMPONENTS OF RAILWAY ENGINEERING:** Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.<br>**GEOMETRIC DESIGN OF RAILWAY TRACK:** Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves. |
| **UNIT-II** | **TURNOUTS &CONTROLLERS:** Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing, Signal Objectives – Classification – Fixed signals – Stop signals – Signaling systems – Mechanical signaling system – Electrical signaling system – System for Controlling Train Movement – Interlocking – Modern signaling Installations. |
| **UNIT-III** | **AIR TRANSPORTATION SYSTEM:** Development of air transportation system with particular reference to India; Aero plane components; Air–craft characteristics. Airport Planning &Design: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control. |
| **UNIT-IV** | **RUNWAY DESIGN:** Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements– Airport Drainage – Design of surface and subsurface drainage. |
| **UNIT-V** | **WATER TRANSPORTATION:**<br>Types of water transportation; advantages and disadvantages of water transportation. Planning, Layout, Construction & Maintenance Of Docks & Harbours: Classification of ports - Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves<br>Jetties – Fender systems .Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbours – Navigational aids. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | 'Railway Engineering' by Satish Chandra and Agarwal M.M. |
| **2.** | 'Airport Engineering' by Khanna & Arora - Nemchand Bros |
| **3.** | 'Docks and Harbour Engineering' by Bindra S.P. – Dhanpathi Rai & Sons. |
| **REFERENCE BOOK** | |
| **1.** | "Railway Engineering" by Saxena &Arora –Dhanpat Rai Publications, NewDelhi. |
| **2.** | 'Transportation Engineering Planning Design' by Wright P.H. &Ashfort N.J. - John Wiley &Sons. |
| **3.** | 'Airport Engineering' by Virendra Kumar, DhanpatRai Publishers, NewDelhi. |

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|---|---|
| **4.** | 'Transportation Engineering' by Srinivasa Kumar R, University Press,Hyderabad. |
| **5.** | 'Highway, Railway, Airport and Harbour Engineering' by Subramanian KP, Sci tech Publications (India) Pvt. Limited, Chennai. |
| **6.** | Airport Engineering by G.V. Rao, Tata McGraw Hill, NewDelhi. |
| **7.** | S. C. Rangawala, 'Railway Engineering', 25th Ed., Charotar Publishing House Pvt. Ltd., 2015. |
| **8.** | Airport Engineering by G.V.Rao; Tata McGraw Hill. |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105107123/ |

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|---|---|---|---|---|---|---|
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## GEOTECHNICAL ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE5L04 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To impart knowledge of determination of index properties required for classification of soils. |
| **2** | To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils. |
| **3** | To teach how to determine shear parameters of soil through different laboratory tests. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Determine the dry density of field and OMC. |
| **CO2** | Examining the rate of Permeability of soil. |
| **CO3** | Identify the type of soil existing in field. |
| **CO4** | Evaluate the shear strength parameters from field and laboratory. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 2 | -- | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 3 | -- | 2 |
| **CO2** | 2 | -- | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 3 | -- | 2 |
| **CO3** | 2 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 3 | -- | 2 |
| **CO4** | 2 | -- | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 3 | -- | 2 |
| **CO5** | 2 | -- | 3 | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 3 | -- | 2 |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| **1** | Determination of Specific gravity of soil solids, $G_s$. (IS-2720-Part 3-1980) |
| **2** | Determination of soil Atterberg's Limits. (IS-2720-Part 5-1985) |
| **3** | Determination of Field density by Core cutter and Sand replacement methods. (IS-2720-Part 28-1974) |
| **4** | Determination of soil Grain size analysis by sieving. (IS-2720-Part 4-1985) |
| **5** | Determination of soil Grain size analysis by hydrometer analysis. (IS-2720-Part 4-1985) |
| **6** | Determination of Permeability of soil - Constant head test & Variable head test. (IS-2720-Part 17-1986). |
| **7** | Determination of dry density and OMC by using Compaction test. (IS-2720-Part 8-1983) |
| **8** | Determination of coefficient of consolidation. (IS-8009-Part 1-1976) |
| **9** | Determination of Shear strength parameters by using box shear test. (IS-2720-Part 13-1986) |
| **10** | Determination of Shear strength parameters by using tri-axial (UU test). (IS-2720-Part 11-1993) |
| **11** | Determination of Shear strength parameters by using Vane Shear test. (IS-4434-Part 3-1978) |
| **12** | Determination of CBR Value. (IS-2720-Part 16-1979) |

*Note: At least 10 Experiments has to be completed

| **S NO.** | **LIST OF EQUIPMENTS** |
|---|---|
| **1.** | Casagrande's liquid limit apparatus. |
| **2.** | Apparatus for plastic and shrinkage limits |
| **3.** | Field density apparatus for Core cutter method. |

| | |
|---|---|
| **4.** | Sand replacement testing setup. |
| **5.** | Set of sieves: 4.75 mm, 2 mm, 1 mm, 0.6 mm, 0.425 mm, 0.3 mm, 0.15 mm, and 0.075 mm. |
| **6.** | Hydrometer apparatus. |
| **7.** | Permeability apparatus for Constant head test and Variable head test |
| **8.** | Apparatus for Compaction test. |
| **9.** | Apparatus for Consolidation test. |
| **10.** | Apparatus for Tri-axial test. |
| **11.** | Apparatus for Vane shear test. |
| **12.** | Apparatus for CBR test. |
| **13.** | Apparatus for Box shear test |
| **14.** | Air-dry oven |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006. |
| **2.** | "Soil Mechanics - Laboratory manual" by Braja M. Das 6th Edition |
| **REFERENCE BOOKS** | |
| **1.** | Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015 |
| **2.** | IS Code 2720 – relevant parts |

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## CONCRETE TECHNOLOGY LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE5L06 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Concrete Technology | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To impart the various testing methods, testing procedures and properties of cement. |
| **2** | To impart the various testing methods to determine the basic properties of concrete ingredients. |
| **3** | To learn various fresh and hardened properties of concrete. |

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| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Find the properties of bricks and cement. |
| **CO2** | Determine the properties of aggregates. |
| **CO3** | Identify the properties of concrete |

| **Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |
| **CO2** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |
| **CO3** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |

| **S NO.** | **LIST OF EXPERIMENTS** |
|---|---|
| **1** | Determination of normal Consistency and fineness of cement. (IS-4031 Part-I & IV 1988) |
| **2** | Determination of initial setting time and final setting time of cement. (IS-4031 Part-V 1988) |
| **3** | Determination of specific gravity and soundness of cement. (IS-4031 Part-II & III 1988) |
| **4** | Determination of compressive strength of cement. (IS-4031 Part-VI 1988) |
| **5** | Determination of grading and fineness modulus of fine aggregate and coarse aggregate by sieve analysis. (IS-383 - 1970) |
| **6** | Determination of specific gravity of coarse aggregate. (IS-2386 Part-III 1963) |
| **7** | Determination of bulking of sand. (IS-2386 Part-III 1963) |
| **8** | Determination of workability of concrete by compaction factor method. (IS-1199 – 1959, SP 23 - 1982) |
| **9** | Determination of workability of concrete by slump test. (IS-7320 – 1974,IS 1199 – 1959, SP 23 - 1982) |
| **10** | Determination of workability of concrete by Vee-bee test. (IS 456 – 2000, IS 1199 - 1959, IS 10510 – 1983) |
| **11** | Determination of compressive strength of concrete and its young's modulus. (IS 516 – 1959, IS 1199 - 1959, SP 23 – 1982 IS 10086 - 1982) |
| **NOTE:** At least 10 experiments must be conducted (at least one for each property). | |

| **S NO.** | **LIST OF EQUIPMENTS** |
|---|---|
| **1** | Standard set of sieves for coarse aggregate and fine aggregate. |
| **2** | Vicat's apparatus. |
| **3** | Specific gravity bottle. |
| **4** | Lechatlier's apparatus. |
| **5** | Slump Test Apparatus. |

| | |
|---|---|
| **6** | Compaction Factor Test Apparatus. |
| **7** | Vee - Bee test apparatus. |
| **8** | Universal testing Machine (UTM) / Compression Testing Machine (CTM). |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Concrete Technology by M. S. Shetty. – S. Chand & Co., 2004. |
| **2.** | Concrete Technology by M. L. Gambhir. – Tata Mc. Graw Hill Publishers, NewDelhi. |
| **REFERENCE BOOKS** | |
| **1.** | Properties of Concrete by A. M. Neville – PEARSON – 4thedition. |
| **2.** | Concrete Technology by A.R. Santha Kumar, Oxford University Press, NewDelhi. |
| **WEB REFERENCES** | |
| **1.** | http://freevideolectures.com/Course/3357/Concrete-Technology |

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## GEODESY LABORATORY-II LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE5L07 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Geodesy &Geodesy Laboratory-I | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To perform various methods of linear and angles measurements by Using Theodolite. |
| **2** | To perform various methods for finding distances by using Theodolite |
| **3** | To introduce the students to basic principles of Total station. |
| **4** | To enable the students to use Total station. |

| | |
|---|---|
| **5** | To integrate the knowledge of measuring remote heights. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Understand fundamentals about Theodolite instrument |
| **CO2** | Identify the distance between two inaccessible points |
| **CO3** | Calculating vertical distance problems by tachometric principles |
| **CO4** | Explain modern instruments in surveying. |
| **CO5** | Find errors in the field by using total station |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | 2 | 1 | -- | 2 | 1 | 2 | 2 | 2 | -- | -- | -- | -- |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | -- | 3 | 2 | 2 | 2 | -- | -- | -- |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 3 | -- | -- | -- |
| **CO4** | 3 | 3 | 3 | -- | 1 | 2 | -- | 3 | 2 | 2 | 2 | 2 | -- | -- | -- |
| **CO5** | 3 | 3 | 3 | 2 | 1 | -- | -- | 3 | 3 | 2 | 2 | 2 | -- | -- | -- |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| **1** | Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method. |
| **2** | Theodolite Survey: Finding the distance between two inaccessible points. |
| **3** | Theodolite Survey: Finding the height of far object. |
| **4** | Tachometric survey: Heights and distance problems using tachometric principles. |
| **5** | One Exercise on Curve setting. |
| **6** | One Exercise on contours. |
| **7** | Total Station: Introduction to total station and practicing setting up, leveling up and elimination of parallax error. |
| **8** | Total Station: Determination of area using total station. |
| **9** | Total Station :Traversing |
| **10** | Total Station :Contouring |
| **11** | Total Station: Determination of Remote height. |
| **12** | Total Station: distance between two inaccessible points. |

| **S. NO.** | **LIST OF EQUIPMENTS** |
|---|---|
| **1** | Theodolite |
| **2** | Total station |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Surveying (Vol. No.1, 2 &3) by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain– Laxmi Publications (P) ltd, New Delhi. |
| **2.** | Advance Surveying by Satish Gopi, R. Sathi Kumar and N. Madhu, Pearson Publications. |
| **REFERENCE BOOKS** | |
| **1.** | Text book of Surveying by S.K. Duggal (Vol. No. 1&2), Tata McGraw Hill Publishing Co. Ltd., New Delhi. |
| **2.** | Text book of Surveying by Arora (Vol. No. 1&2), Standard Book House, Delhi. |

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## WATER SUPPLY & WASTE WATER ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE6T19 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Basic Chemistry & Fluid Mechanics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants. |
| **2** | Provide knowledge of characterization of wastewater generated in a community. |
| **3** | Impart understanding of treatment of sewage and the need for its treatment. |
| **4** | Summarize the appurtenance in sewerage systems and their necessity. |
| **5** | Effluent disposal method and realize the importance of regulations in the disposal of effluents in rivers. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Classify sources of water and their characteristics |
| **CO2** | Identify various water treatment methods and know about their functions |
| **CO3** | Interpreting the design of sewers and plumbing systems |
| **CO4** | Examine the effects and primary treatment of sewage |
| **CO5** | Examine the effects of advance treatment technology and reuse of sewage |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | -- | -- | 2 | 3 | -- | -- | 1 | 3 | -- | 3 | 3 | -- | -- | 3 | 3 |
| **CO2** | 3 | -- | 3 | 2 | 2 | 2 | -- | 3 | -- | 3 | -- | -- | 3 | 3 | 3 |
| **CO3** | 3 | -- | 3 | 2 | -- | 2 | -- | -- | -- | 3 | -- | -- | 3 | 2 | 3 |
| **CO4** | 2 | -- | 3 | 2 | 3 | -- | -- | -- | -- | 3 | 2 | 3 | 3 | 2 | 3 |
| **CO5** | 2 | 2 | 3 | 2 | 2 | -- | -- | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **SOURCES OF WATER**<br>Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterisation – Significance – Drinking Water quality standards. |
| **UNIT-II** | **WATER TREATMENT**<br>Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management –Construction, Operation and Maintenance aspects. |
| **UNIT-III** | **PLANNING AND DESIGN OF SEWERAGE SYSTEM**<br>Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design - Storm runoff estimation – sewer appurtenances – sewage pumping-drainage in buildings-plumbing systems for drainage- Discharge standards for Effluents. |
| **UNIT-IV** | **PRIMARY TREATMENT OF SEWAGE**<br>Objectives – Unit Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank- Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks –Operation and Maintenance aspects. |
| **UNIT-V** | **SECONDARY TREATMENT OF SEWAGE**<br>Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems –Rotating biological contactors -Trickling filters Waste Stabilization Ponds – Operation and Maintenance |

| TEXT BOOKS | |
|---|---|
| **1.** | Water supply and sanitary Engineering by Rangwala, Charotar Publications, Edition 2019. |
| **2** | Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015. |
| **REFERENCE BOOKS** | |
| **1.** | Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013. |
| **2.** | Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010. |
| **3.** | Syed R. Qasim “Wastewater Treatment Plants”, CRC Press, Washington D.C.,2010. |
| **4.** | Gray N.F, “Water Technology”, Elsevier India Pvt. Ltd., New Delhi, 2006. |
| **5.** | Punmia, B.C., Jain, A.K., and Jain. A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010. |

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## GEOTECHNICAL ENGINEERING - II

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE6T20 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Geotechnical engineering-I | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Able to learn the consolidation settlements. |
| **2** | To understand the concepts of shear strength, stresses induced and to determine various parameters. |
| **3** | To determine the magnitude and line of action of lateral earth pressure. |
| **4** | To impart knowledge to plan and execute a detail site investigation program. |
| **5** | To learn about stability of the slopes in different conditions. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Determine the degree of consolidation of soil. |
| **CO2** | Determine the shear strength parameters of soil. |
| **CO3** | Design different types of retaining walls. |
| **CO4** | Interpret the soil conditions from soil exploration. |
| **CO5** | Selecting an appropriate slope stability analysis method for a given slope. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| **CO2** | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 3 | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **CONSOLIDATION:**<br>Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation ($C_v$) – Over consolidated and normally consolidated clays. |

| | |
|---|---|
| **UNIT-II** | **SHEAR STRENGTH:**<br>Shear strength of cohesive and cohesionless soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCS and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction. |
| **UNIT-III** | **EARTH RETAINING STRUCTURES:**<br>Rankine's & Coulomb's theory of earth pressure – Culmann's graphical method - earth pressures in layered soils, Earth pressure at rest, Jaky's formula |
| **UNIT-IV** | **SITE INVESTIGATION AND SELECTIONOF FOUNDATION:**<br>Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed samples – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT, CPT) – Data interpretation - Selection of foundation based on soil condition- Bore log report. |
| **UNIT-V** | **STABILITY OF SLOPES:**<br>Infinite and finite earth slopes in sand and clay – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices – Taylor's Stability Number, Stability of slopes of dams and embankments. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | 'Principles of Foundation Engineering' by Das, B.M., - (2011) –6th edition (Indian edition) Cengage learning. |
| **2.** | 'Basic and Applied Soil Mechanics' by Gopal Ranjan & ASR Rao, New Age International Pvt. Ltd,(2004) |
| **REFERENCE BOOKS** | |
| **1.** | 'Foundation Analysis and Design' by Bowles, J.E., (1988) – 4th Edition, McGraw-Hill Publishing Company, Newyork. |
| **2.** | 'Theory and Practice of Foundation Design' by N.N.Som & S.C.Das PHI Learning Private limited. |
| **3.** | 'Fundamentals of Soil Mechanics' by D.W. Taylor., Wiley. |
| **4.** | 'An introduction to Geotechnical Engineering' by Holtz and Kovacs; Prentice Hall. |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105103097/ |
| **2.** | http://www.nptelvideos.in/2012/11/foundation-engineering.html |

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# DESIGN & DETAILING OF STEEL STRUCTURES

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE6T21 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Strength of Materials, Structural Analysis–I & Structural analysis–II. | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. |
| **2** | To provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Recognize the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths. |
| **CO2** | Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams |
| **CO3** | Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria. |
| **CO4** | Identify and compute the design loads on Industrial structures. |
| **CO5** | Find out ultimate load of steel beams and portal frames using plastic analysis. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | - | - | - | - | - | - | 2 | - | 2 | 3 | 2 | - |
| **CO2** | 2 | 2 | 3 | - | 2 | - | - | - | - | - | 2 | 2 | 2 | 2 | - |
| **CO3** | 2 | 2 | 3 | - | 2 | - | - | - | - | - | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 3 | - | 2 | 2 | - | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 |
| **CO5** | 2 | 3 | 3 | 2 | - | - | 1 | - | - | - | - | 3 | 2 | 2 | 3 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS:** General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint. |
| **UNIT-II** | **BEAMS:** Design requirements as per IS Code - Design of laterally supported and unsupported beams - Design of built-up beams - Check for Deflection, Shear, Buckling, Bearing, laterally unsupported beams. |
| **UNIT-III** | **TENSION AND COMPRESSION MEMBERS:** Behavior and Design of simple and built-up members subjected to tension - Shear lag effect - Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory-Design of simple and built-up compression members with lacing and battens - Design of column bases - slab base and gusseted base |
| **UNIT-IV** | **DESIGN OF ROOF TRUSSES:** Design of roof trusses – loads on trusses – Purlin design using angle and channel sections – truss design, Design of joints and end bearings. |
| **UNIT-V** | **DESIGN OF PLATE GIRDER:** Design consideration – IS Code recommendations Design of plate girder – Welded – Curtailment of flange plates, stiffeners – splicing and connections, Introduction to gantry girders. |

| TEXT BOOKS | |
|---|---|
| **1.** | "Design of steel structures" as per Limit State Method of Design by S.S.Bavakati, International Publishing House Pvt.Ltd. |
| **2.** | "Limit state Design of steel structures" by S. K. Duggal, Tata Mcgraw Hill, and New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | IS -800 – 2007, IS – 875 |
| **2.** | Steel Tables. (These codes and steel tables are permitted to use in the examinations). |
| **3.** | "Steel Structures Design and Practice" by N. Subramanian, Oxford University Press. |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105106112/ |

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# WATER RESOURCE ENGINEERING-I

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE6T22 |
| **Course Type** | 19CE6T22 | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Hydraulics and Hydraulic Machinery | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce hydrologic cycle and its relevance to Civil engineering. |
| **2** | Make the students understand physical processes in hydrology and, components of the hydrologic cycle. |
| **3** | Appreciate concepts and theory of physical processes and interactions. |
| **4** | Learn measurement and estimation of the components hydrologic cycle. |
| **5** | Provide an overview and understanding of Unit Hydrograph theory and its analysis. |
| **6** | Understand flood frequency analysis, design flood, flood routing. |
| **7** | Appreciate the concepts of groundwater movement and well hydraulics. |
| **8** | Learn overview of flood routing and its effects. |
| **9** | Has to be understood and identify the flood occurring areas nearby. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain the theories and principles governing the hydrologic processes and list out the forms of precipitation in real conditions. |
| **CO2** | Apply key concepts to several practical areas of engineering hydrology and related design aspects. |
| **CO3** | Design major hydrologic components for a need based structures. |
| **CO4** | Estimate flood magnitude and carry out flood routing. |
| **CO5** | Demonstrate the recuperation test process in open wells. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO2** | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **INTRODUCTION:**<br>Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, Frequency of point rainfall, Rain fall data in India. Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm, problems on average rainfall on towns. |
| **UNIT-II** | **ABSTRACTIONS FROM PRECIPITATION:**<br>Introduction, Initial abstractions.<br>**EVAPORATION:**<br>Factors affecting, measurement, reduction, Analytical methods of Evaporation estimation.<br>**EVAPOTRANSPIRATION:**<br>Factors affecting, measurement, control, Potential Evapotranspiration over India.<br>**INFILTRATION:**<br>Factors affecting, Infiltration capacity curve, measurement, Infiltration Indices. Problems on $\phi$-Index and W-Index. |
| **UNIT-III** | **RUNOFF:**<br>Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.<br>**HYDROGRAPH ANALYSIS:**<br>Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S- hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph. Problems on unit hydrograph. |
| **UNIT-IV** | **FLOODS:**<br>Causes and effects, frequency analysis - Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management, Design flood, Design storm.<br>**FLOOD ROUTING:**<br>Hydrologic storage routing, channel and reservoir routing- Muskingum and Puls methods of routing, flood control in India.<br>**ADVANCED TOPICS IN HYDROLOGY:**<br>Rainfall-Runoff Modelling, Instantaneous Unit Hydrograph (IUH) - Conceptual models - Clark and Nash models, general hydrological models- Chow - Kulandaiswamy model. |
| **UNIT-V** | **GROUNDWATER:**<br>Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, specific capacity, permeability, transmissivity and storage coefficient, types of wells, well loss, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt. Ltd, (2013), NewDelhi. |
| **2.** | 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013). |
| **2.** | 'Hydrology' by Raghunath. H.M., New Age International Publishers,(2010). |
| **3.** | 'Engineering Hydrology –Principles and Practice' by Ponce V.M., Prentice Hall International,(1994). |
| **4.** | 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications,(2011). |
| **5.** | 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt.Ltd., Transportation Engineering-Id., (2011), NewDelhi. |
| **6.** | 'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press,(2010). |

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# ENVIRONMENTAL ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE6L08 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Water and Waste Water Engineering | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Estimation some important characteristics of water and wastewater in the laboratory. |
| **2** | It also gives the significance of the characteristics of the water and waste water. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Perform the different laboratory techniques for examining the water quality parameters. |
| **CO2** | Perform the different laboratory techniques for examining the wastewater quality parameters. |
| **CO3** | Analyze the laboratory data and comment with respect to permissible limits and field conditions. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 3 | 2 | 1 | 1 | -- | 1 | 1 | 1 | -- | 2 | 2 | 2 |
| **CO2** | 2 | 3 | 3 | 2 | 1 | 1 | 1 | -- | 1 | 1 | 1 | -- | 1 | 2 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 1 | 1 | 1 | -- | 1 | 1 | 1 | -- | 1 | 2 | 2 |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| **1** | Determination of pH and Electrical Conductivity (Salinity) of Water and Soil. |
| **2** | Determination and estimation of Total Hardness–Calcium &Magnesium. |
| **3** | Determination of Alkalinity/Acidity. |
| **4** | Determination of Chlorides in water and soil. |
| **5** | Determination and Estimation of total solids, organic solids and inorganic solids and settle able solids by Imhoff Cone. |
| **6** | Determination of Dissolved Oxygen with D.O. Meter & Wrinklers Method. |
| **7** | Physical parameters – Temperature, Colour, Odour, Turbidity, Taste. |
| **8** | Determination of B.O.D and C. O. D. |
| **9** | Determination of Optimum coagulant dose. |
| **10** | Determination of Chlorine demand. |

| S NO. | LIST OF EQUIPMENTS |
|---|---|
| **1** | pH meter |
| **2** | Turbidity meter |
| **3** | Conductivity meter |
| **4** | Hot air oven |
| **5** | Muffle furnace |
| **6** | Dissolved Oxygen meter |
| **7** | Jar Test Apparatus |
| **8** | COD Reflux Apparatus |
| **9** | BOD incubator |
| **10** | Hazen's Apparatus |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Standard Methods for Analysis of Water and Waste Water –APHA. |
| **2.** | Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, NewDelhi. |
| **REFERENCE BOOKS** | |
| **1.** | Relevant IS Codes. |
| **2.** | Chemistry for Environmental Engineering by Sawyer and Mc.Carty. |

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# TRANSPORTATION ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE6L09 |
| **Course Type** | Practical | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Highway Engineering | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To study the properties and judge the suitability to use as road materials. |
| **2** | To study the properties and stability requirements of the Bitumen mixes. |
| **3** | To carry out surveys for traffic volume, speed and parking. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain the bitumen nature and their quality behavior. |
| **CO2** | Utilize aggregate and bitumen properties in pavement design. |
| **CO3** | Determine the suitability of materials for the road construction. |
| **CO4** | Determine the traffic volume, speed and parking characteristics. |
| **CO5** | Predict the optimum bitumen content for the mix Design and mix proportions of the bitumen mixes. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |
| **CO2** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |
| **CO3** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |
| **CO4** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |
| **CO5** | 3 | -- | 3 | -- | -- | 2 | -- | -- | -- | -- | 2 | -- | 2 | 3 | 3 |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| **1** | **ROADAGGREGATES:**<br>1. To determine the Aggregate Crushing value. (IS:2386 Part-IV 1963)<br>2. To determine the Aggregate Impact value. (IS:2386 Part-IV 1963)<br>3. To determine the specific Gravity and Water Absorption test for aggregates. (IS:2386 Part-III 1963) |

| | |
|---|---|
| | 4. To conduct the Attrition Test for aggregates. (IS:2386 Part-V 1963)<br>5. To conduct the Abrasion Test for aggregates. (IS:2386 Part-V 1963)<br>6. To conduct the Shape tests for aggregates. (IS:2386 Part-I 1963) |
| **2** | **BITUMINOUSMATERIALS:**<br>1. To determine the Penetration value. (IS:1203-1978)<br>2. To conduct Ductility Test. (IS:1208-1978)<br>3. To determine the Softening Point. (IS:1205-1978)<br>4. To determine the Flash and fire point. (IS:1209-1978)<br>5. To conduct Stripping Test. (IS:6241-1971)<br>6. To determine the Viscosity. (IS:1206-1978) |
| **3** | **BITUMINOUS MIX:**<br>1. To determine the Marshall Stability Number. |
| **4** | **TRAFFIC SURVEYS:**<br>1. To conduct Traffic volume study at mid-blocks.<br>2. To conduct Traffic Volume Studies (Turning Movements) at intersection.<br>3. To conduct Spot speed studies.<br>4. To conduct Parking study. |
| **5** | **DESIGN & DRAWING:**<br>1. Earthwork calculations for road works.<br>2. Drawing of road cross sections. |

| S NO. | LIST OF EQUIPMENTS |
|---|---|
| **1** | Aggregate Crushing Value apparatus |
| **2** | Aggregate Impact testing |
| **3** | Pycnometer |
| **4** | Density Basket |
| **5** | Specific Gravity bottle 100ml |
| **6** | Deval's Attrition Testing Machine |
| **7** | Los Angeles Abrasion Machine with counter |
| **8** | Thickness Gauge |
| **9** | Length Gauge |
| **10** | Bitumen Penetrometer Electronic (Universal Penetrometer) |
| **11** | Ductility Testing Machine |
| **12** | Ring and ball Apparatus |
| **13** | Marshall Mix Design Apparatus |
| **14** | Stop watches |
| **15** | Vicat apparatus |
| **16** | Le-chatler apparatus |

| | |
|---|---|
| **17** | Bulk density test |

| **TEXT BOOKS** | |
|---|---|
| **1.** | 'Traffic Engineering and Transportation' Planning by Kadiyali L.R,Khanna Publishers, NewDelhi. |
| **2.** | 'Highway Engineering' by Khanna S.K., Justo C.E.G and Veeraragavan A,Nem Chand Bros,Roorkee. |
| **REFERENCE BOOKS** | |
| **1.** | 'Transportation Engineering and Planning' by Papacostas C.S. and PD Prevedouros, Prentice Hall of India Pvt. Ltd; NewDelhi. |
| **2.** | 'Principles of Highway Engineering' by Kadiyali LR, Khanna Publishers, NewDelhi. |

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## COMPUTER AIDED ENGINEERING DRAWING LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE6L10 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Building planning & Drawing | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce computer aided drafting packages and commands for modelling and sketching. |
| **2** | To draw the geometric entities and create 2D and 3D wire frame models. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Use the software packers for drafting and modeling |
| **CO2** | Create 2D and 3D models of Engineering Components |
| **CO3** | Draw objects using AUTOCAD |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | -- | -- | 2 | -- | -- | 1 | -- | 3 | 3 | 1 |
| **CO2** | 3 | 3 | 3 | 2 | 1 | -- | -- | 2 | -- | -- | 1 | -- | 3 | 3 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 1 | -- | -- | 2 | -- | -- | 1 | -- | 3 | 3 | 1 |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| **1** | Introduction to CAD software and its functional keys. |
| **2** | Generation of points, lines, curves, polygons, dimensioning. |
| **3** | Types of modelling: object selection commands – edit, zoom, cross hatching, pattern filling, utility commands. |
| **4** | 2D wire frame modelling. |
| **5** | 3D wire frame modelling. |
| **6** | Examples to exercise different options like save restore, delete, joint, single option. |
| **7** | **Computer Aided Solid Modelling:** Isometric projections. |
| **8** | **Computer Aided Solid Modelling:** Orthographic projections. |
| **9** | Modelling of simple solids. |

| S NO. | LIST OF EQUIPMENTS |
|---|---|
| **1** | Equipment needed: Computers and Software: AutoCAD 2017 |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Mastering Auto CAD 2017 and Auto CAD LT 2017 – George Omura, Sybex |
| **REFERENCE BOOKS** | |
| **1.** | Auto CAD 2017 fundamentals- Elisemoss, SDCPub |
| **2.** | Engineering Drawing + AutoCAD – K. Venugopal, V. Prabhu Raja, NewAge. |

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# FOUNDATION ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE7T33 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Geotechnical engineering I & II | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To acquire the knowledge of shallow foundation and their bearing capacities. |
| **2** | Learning about types and purposes of different foundation systems and structures. |
| **3** | To provide students with exposure to the standard methods of designing foundation. |
| **4** | To discuss and evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect of soil behavior. |
| **5** | To build the necessary theoretical background for design and construction of foundation system. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Determine safe bearing capacity for design of buildings. |
| **CO2** | Identify a suitable foundation system for a structure. |
| **CO3** | Analyze and design pile foundations. |
| **CO4** | Demonstrate an ability to analysis and design of well foundation |
| **CO5** | Evaluate the importance of raft foundation and principles of design for buildings and tower structures. |

**Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| **CO2** | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **FOUNDATION DESIGN BASICS:**<br>Criteria for choice of foundation, bearing capacity, total and differential settlements, tolerance for various types of structures, Interpretation of soil profile from design parameters like modulus of compressibility, Modulus of subgrade reaction, Poisson's ratio, etc |
| **UNIT-II** | **SHALLOW FOUNDATIONS – BEARING CAPACITY AND SETTLEMENT CRITERION:**<br>Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination of bearing capacity - Factors influencing bearing capacity – Analytical methods to determine bearing capacity – Terzaghi's theory, Meyerhof theory – IS Method. Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures, Design of retaining wall. |
| **UNIT-III** | **RAFT FOUNDATIONS:**<br>Raft foundations for building and tower structures, including effects of soil-structure interaction and nonlinearity, different types of rafts |
| **UNIT-IV** | **DEEP FOUNDATIONS :**<br>Pile foundation-types, methods of installation, codal practices for permissible load under vertical and lateral loads, stresses during pile driving, load carrying capacity of pile groups, negative skin friction, under-reamed piles, Pile load test, equipment used for construction of foundation systems. |
| **UNIT-V** | **WELL FOUNDATIONS**:<br>Types – Different shapes of wells – Components of well– functions – forces acting on well foundations - Design Criteria –Determination of staining thickness and plug - construction and Sinking of wells – Tilt and shift. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | B.M Das, "Principles of Foundation Engineering", 4th Edition, Indian edition |
| **2.** | Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw- Hill International, 2000 |
| **REFERENCE BOOKS** | |
| **1.** | Swami Saran, "Analysis and Design of Substructures", 2nd Edition, Oxford & IBH Publishing Company Pvt. Ltd., 2009 |
| **2.** | Gopal Ranjan & ASR Rao, "Basic and Applied Soil Mechanics", 3rd Edition, New Age International Pvt. Ltd, Publishers, 2002. |

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# WATER RESOURCE ENGINEERING-II

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE7T26 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Water Resource Engineering-I | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the types and design of irrigation systems. |
| **2** | Discuss the relationships between soil, water and plant and their significance in planning an irrigation system. |
| **3** | Understand design methods of erodible and non-erodible canals. |
| **4** | Know the principles of design of hydraulic structures on permeable foundations. |
| **5** | Know the concepts for analysis and design principles of storage, diversion head works and canal structures. |
| **6** | Know about the major differences between super passage and Aqueduct. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Demonstrate the irrigation types and methods. |
| **CO2** | Design principles of Unlined and Lined canals. |
| **CO3** | Estimate the life of reservoir and storage capacity. |
| **CO4** | Apply the concepts of Bligh's creep theory and Khosla's theory. |
| **CO5** | Apply the design principles of cross drainage works. Design of super passage and canal regulator. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 1 | 2 | 1 | -- | -- | -- | 1 | -- | 1 | -- | 3 |
| **CO2** | 3 | 2 | 2 | 2 | 1 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 3 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 3 | 3 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 3 |
| **CO4** | 2 | 2 | 2 | 2 | 1 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 3 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **IRRIGATION:** Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation. |
| **UNIT-II** | **CANALS:** Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals – Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting, design of lined canal.<br>**SPILLWAYS:** Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances. |
| **UNIT-III** | **RESERVOIR PLANNING:** Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.<br>**DAMS:** Types of dams, selection of type of dam, selection of site for a dam.<br>**GRAVITY DAMS:** Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries, grouting.<br>**EARTH DAMS:** Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions. |
| **UNIT-IV** | **DIVERSION HEAD WORKS:** Types of diversion head works, weirs and barrages, layout of diversion head works, components. Causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient. |
| **UNIT-V** | **CANAL STRUCTURES FALLS:** Types and location, design principles of Sarda type fall, trapezoidal notch fall and straight glacis fall.<br>**REGULATORS:** Head and cross regulators, design principles.<br>**CROSS DRAINAGE WORKS:** Types, selection, design principles of aqueduct, siphon aqueduct and super passage.<br>**OUTLETS:** Types, Proportionality, Sensitivity and Flexibility.<br>**RIVER TRAINING:** Objectives and approaches, interlocking system of rivers |

**TEXT BOOKS**


| | |
|---|---|
| **1.** | "Irrigation and Water Power Engineering" by Punmia B C, P.B.B Lal, A.K. Jainand A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi. |
| **2.** | "Irrigation Water Resources and Water Power Engineering" by Modi P N (2011), Standard Book House, NewDelhi. |

| REFERENCE BOOKS | |
|---|---|
| 1. | "Water Resources Engineering" by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi. |
| 2. | "Irrigation Engineering" by Sharma R.K. and Sharma, T.K (2012), S.Chand& Co. Publishers. |
| 3. | "Water Resources Engineering" by Satyanarayana Murthy Challa (2008), New Age International Publishers. |

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## PROFESSIONAL ELECTIVE-I: GROUND IMPROVEMENT TECHNIQUES

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T27 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To make the student how to improving the properties of remoulded and in-situ soils by adopting different ground improvement techniques such as compaction, dewatering systems, vibration methods etc. |
| 2 | To enable the students to know how reinforced soil can be used to improve the engineering properties of soils. |
| 3 | To make the student understand how to stabilize the different types of poor quality soils. |

| COURSE OUTCOMES | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Identify various problems associated with soil deposits, formulate and methods to evaluate them. |
| **CO2** | Ability to design a dewatering system, component or process as per needs and specifications. |
| **CO3** | Explain the concept involved for in-situ treatment of cohesive and cohesionless soils and ability required to design an appropriate techniques to implement ground improvement methods. |
| **CO4** | Ability to design reinforced earth retaining structure. |
| **CO5** | Ability to design retaining walls, its component or process as per the needs and specifications. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 1 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES**<br>Role of ground improvement in foundation engineering – Methods of ground improvement Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions. |
| **UNIT-II** | **DEWATERING**<br>Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases. |
| **UNIT-III** | **INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS**<br>In-situ densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations. separation, road works and containment applications |

| | |
|---|---|
| | |
| **UNIT-IV** | **EARTH REINFORCEMENT**<br>Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications. |
| **UNIT-V** | **GROUTING TECHNIQUES**<br>Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring Stabilization with cement, lime and chemicals – Stabilization of expansive soil. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Purushothama Raj. P, "Ground Improvement Techniques", Firewall Media, 2005. |
| **2.** | Bikash Chandra chattopadhyay and Joyanta Maity, " Ground Improvement Techniques", PHI Learning Pvt. Ltd., 2017 |
| **REFERENCE BOOKS** | |
| **1.** | Koerner, R.M., "Designing with Geosynthetics" (Fourth Edition), Prentice Hall, Jersey, 2012. |
| **2.** | Moseley, M.P., "Ground Improvement Blockie Academic and Professional", Chapman and Hall, Glasgow, 2004. |

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| **Dr. P. Subba Rao** | **Dr. D. Rama Seshu** | **Dr. D. S Murthy** | **Mr. M. Sandeep** | **Mr. V. Manideep** | **Mr. A. Raviteja** | **Mr. A. Roger Antony** |

## PROFESSIONAL ELECTIVE-I: REPAIR & MAINTENANCE OF STRUCTURES

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T28 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Familiarize Students with deterioration of concrete in structures. |
| **2** | Equip student with concepts of NDT and evaluation. |
| **3** | Understand failures and causes for failures in structures. |
| **4** | Familiarize different materials and techniques for repairs |
| **5** | Understand procedure to carryout Physical evaluation of buildings and prepare report. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Assess the deterioration of concrete in structures |
| **CO2** | Evaluate structures by NDT |
| **CO3** | Assess failures and causes of failures in structures. |
| **CO4** | Applying repair and rehabilitation techniques. Carryout Physical evaluation and submit report on condition of the structure. |
| **CO5** | Application of materials for repair and rehabilitation. |

| Contribution of Course Outcomes towards achievement of program | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 3 | - | - | 2 | - | - | 1 | 1 | - | 1 | - | - | - |
| **CO2** | 3 | 2 | 3 | - | - | 1 | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 2 | 3 | - | - | 1 | - | - | 1 | 1 | - | 1 | 1 | - | 2 |
| **CO4** | 2 | 2 | 3 | - | - | 1 | - | - | 1 | 1 | - | 1 | - | 1 | - |
| **CO5** | 2 | 2 | 3 | - | - | 1 | - | - | 1 | 1 | - | 1 | - | 2 | 2 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **MAINTENANCE AND REPAIR STRATEGIES :** Maintenance Repair and Rehabilitation, Facts and Importance of Maintenance, Various aspects of Inspection, Assessment Procedure for evaluating a damaged structure, Deterioration - Causes, Effects, Types of Deterioration- Physical, Chemical, Mechanical, Preventive measures. |
| **UNIT-II** | **STRENGTH AND DURABILITY OF CONCRETE :** Quality assurance for Concrete - Strength, Durability and Properties of Concrete, Effects of Climate, Temperature, Corrosion, Cover Thickness on Concrete, Non-Destructive Techniques - Rebound hammer, Ultrasonic pulse velocity, Penetration resistance and Pull out test. |
| **UNIT-III** | **FAILURE OF STRUCTURES:** Definition of Structural failure, Causes of failures, Types of failures - Faulty Design, Accidental over Loading, Poor quality of material and Poor Construction practices, Fire damage, Cracks - Types, Causes, Methodology for investigation of failures. |
| **UNIT-IV** | **TECHNIQUES FOR REPAIR AND PROTECTION METHODS :** Repair of Cracks in concrete- Epoxy injection, Jacketing, Underpinning, Shotcreting, and Corrosion protection techniques - Corrosion inhibitors, Corrosion resistant steel, Coating to reinforcement, Cathodic protection, Methods for corrosion measurement by using Corrosion meter test and half-cell potential test. |
| **UNIT-V** | **REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES :** Strengthening of Structural elements, Repair of Structure distressed due to Corrosion, Fire, Leakages, Natural Calamities, Demolition Techniques - Engineering demolition Methods, Case studies |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Shetty.M.S. Jain A K., Concrete Technology - Theory and Practice, S.Chand and Company, Eighth Edition, 2019. |
| **2.** | B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009. |
| **REFERENCE BOOKS** | |
| **1.** | R. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012. |
| **2.** | Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002 |

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| **Dr. P. Subba Rao** | **Dr. D. Rama Seshu** | **Dr. D. S Murthy** | **Mr. M. Sandeep** | **Mr. V. Manideep** | **Mr. A. Raviteja** | **Mr. A. Roger Antony** |

## PROFESSIONAL ELECTIVE-I: TRANSPORTATION PLANNING ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T29 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn various procedures for travel demand estimation. |
| **2** | To various data collection techniques for OD data. |
| **3** | To know various models and techniques for trip generation, trip distribution, mode choice and traffic assignment. |
| **4** | To develop alternative urban transport network plans. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Evaluate various alternative transportation proposals. |
| **CO2** | Identify the corridor and plan for providing good transportation facilities. |
| **CO3** | Describe the fundamental parameters and relationships that characterize the operation of a transportation facility. |
| **CO4** | Describe methods of monitoring, assessing and improving the performance of transportation facilities. |
| **CO5** | Apply queuing models to evaluate the performance of a transportation system. |

| **Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | - |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO4** | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | - |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **URBAN TRANSPORTATION PROBLEMS & TRAVEL DEMAND:** Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques. |
| **UNIT-II** | **DATA COLLECTION AND INVENTORIES**: Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship. |
| **UNIT-III** | **TRIP GENERATION & DISTRIBUTION:** UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models. |
| **UNIT-IV** | **MODE CHOICE ANALYSIS:** Mode Choice Behavior, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation |
| **UNIT-V** | **CORRIDOR IDENTIFICATION, PLAN PREPARATION & EVALUATION:** Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Kadiyali L.R - Traffic Engineering and Transportation Planning -Khanna Publishers, New Delhi. |
| **2.** | Papacostas C.S. - Fundamentals of Transportation Engineering Prentice Hall of India Pvt. Ltd; New Delhi. |
| **REFERENCE BOOK** | |
| **1.** | John Khisty C - Transportation Engineering - An Introduction, Prentice Hall, Englewood Cliffs, New Jersey. |
| **2.** | Nicholas J. Garber, A. Hoel, Raju Sarkar, Cengage learning, Principles of Traffic and Highway Engineering. |
| **3.** | Mayer M and Miller E, Urban Transportation Planning: A decision oriented Approach, McGraw Hill.Bruton, Urban Transportation Planning. |

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## PROFESSIONAL ELECTIVE-I: INDUSTRIAL WASTE MANAGEMENT

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T30 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To make the students understand about industrials waste, its characteristics and effects |
| **2** | To make students to know various sources of industrial waste and how to recycle and reuse them. |
| **3** | To understand what are the various treatment technologies for treating industrial waste |
| **4** | To create wariness of hazardous waste and their treatment |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Define the characteristics of industrial waste and environmental regulation for prevention and control of industrial and hazardous waste |
| **CO2** | Explain waste management approach and interpret the applications of recycle, reuse and byproduct recovery. |
| **CO3** | Classify various sources of waste and its characteristics |
| **CO4** | Interpreting various treatment technologies and its applications |
| **CO5** | Defining hazardous waste and their treatment technologies. |

| **Contribution of Course Outcomes towards achievement of program** |
|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 1 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **INTRODUCTION**<br>Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes |
| **UNIT-II** | **CLEANER PRODUCTION**<br>Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications. |
| **UNIT-III** | **POLLUTION FROM MAJOR INDUSTRIES**<br>Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts |
| **UNIT-IV** | **TREATMENT TECHNOLOGIES**<br>Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganic – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal |
| **UNIT-V** | **HAZARDOUS WASTE MANAGEMENT**<br>Hazardous wastes - Physico chemical treatment – solidification – incineration – Secure land fills |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Rao M. N. & Dutta A. K. , “Wastewater Treatment”, Oxford - IBH Publication, 1995 |
| **2.** | Eckenfelder W.W. Jr., “Industrial Water Pollution Control”, McGraw Hill Book Company, New Delhi, 2000. |
| **REFERENCE BOOKS** | |
| **1.** | Shen T.T., “Industrial Pollution Prevention”, Springer, 1999. |
| **2.** | Stephenson R.L. and Blackburn J.B., Jr., “Industrial Wastewater Systems Hand book”, Lewis Publisher, New York, 1998 |
| **3.** | Freeman H.M., “Industrial Pollution Prevention Hand Book”, McGraw Hill Inc., New Delhi, 1995. |
| **4.** | Bishop, P.L., “Pollution Prevention: Fundamental & Practice”, McGraw Hill, 2000. |
| **5.** | Pandey, "Environmental Management" Vikas Publications, 2010. |

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| **Dr. P.** | **Dr. D.** | **Dr. D. S** | **Mr. M.** | **Mr. V.** | **Mr. A.** | **Mr. A.** |

| Subba Rao | Rama Seshu | Murthy | Sandeep | Manideep | Raviteja | Roger Antony |
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## PROFESSIONAL ELECTIVE-I: URBAN HYDROLOGY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T31 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Appreciate the impact of urbanization on catchment hydrology and understand the importance of short duration rainfall runoff data for urban hydrology studies. |
| **2** | Learn the techniques for peak flow estimation for storm water drainage system design. |

| | |
|---|---|
| **3** | Understand the concepts in design of various components of urban drainage systems. |
| **4** | Learn some of the best management practices in urban drainage. |
| **5** | Understand the concepts of preparation master urban drainage system. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Develop intensity duration frequency curves for urban drainage systems. |
| **CO2** | Identify the techniques to estimate peak flow of storm water and design of drainage system. |
| **CO3** | Develop design storms to size the various components of drainage system. |
| **CO4** | Formulate for best management practices in urban drainage system. |
| **CO5** | Prepare master plan of drainage system for urbanized area. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| **CO5** | 3 | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **INTRODUCTION:** Urbanization and its effect on water cycle – urban hydrologic cycle – trends in urbanization – Effect of urbanization on hydrology. **PRECIPITATION ANALYSIS:** Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration - Frequency (IDF) curves, design storms for urban drainage systems. |
| **UNIT-II** | **APPROACHES TO URBAN DRAINAGE:** Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems. |
| **UNIT-III** | **ELEMENTS OF DRAINAGE SYSTEMS:** Open channel, underground drains, appurtenances, pumping, and source control. |
| **UNIT-IV** | **ANALYSIS AND MANAGEMENT:** Storm water drainage structures, design of storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management. |
| **UNIT-V** | **MASTER DRAINAGE PLANS**: Issues to be concentrated upon – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, and use of models in planning. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | "Manual on Drainage in Urbanized area" by Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, (1987 - 2 volumes),UNESCO. |
| **2.** | "Urban Hydrology" by Hall M J (1984), Elsevier Applied Science Publisher. |
| **REFERENCE BOOKS** | |
| **1.** | "Storm water Detention for Drainage" by Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall. |
| **2.** | "Urban water cycle processes and interactions" by Marsalek et. Al., (2006), Publication No. 78, UNESCO, Paris. |
| **3.** | "Frontiers in Urban Water Management – Deadlock or Hope" by Maksimovic C andJ A Tejada-Guibert (2001), IWA Publishing. |
| **4.** | "Hydrology – Quantity and Quality Analysis" by Wanielista M P and Eaglin (1997), Wiley andSons. |
| **5.** | Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modelling" by Akan A.O and R.L. Houghtalen (2006), Wiley International. |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105105048/M7L7.pdf |
| **2.** | http://nptel.ac.in/courses/105105048/8 |
| **3.** | http://njscdea.ncdea.org/CurveNumbers.pdf |
| **4.** | http://www.iitg.ac.in/kartha/CE551/Lectures/Lecture16.pdf |

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## PROFESSIONAL ELECTIVE-I: AIR POLLUTION & CONTROL

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T32 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| | |
|---|---|
| **COURSE OBJECTIVES** | |
| **1** | To know the analysis of air pollutants. |
| **2** | To know the Threshold Limit Values (TLV) of various air pollutants |
| **3** | To acquire the design principles of particulate and gaseous control. |
| **4** | To learn plume behavior in different environmental conditions. |
| **5** | To learn carbon credits for various day to day activities. |

| COURSE OUTCOMES | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Conduct analysis of air pollutants with climatic change and its impact. |
| **CO2** | Design principles of particulate and gaseous control measures for an industry |
| **CO3** | Examine the plume behavior in a prevailing environmental condition |
| **CO4** | Know the design process for gases pollutant |
| **CO5** | Categorize industries with respect to site selection, zoning, legislation and emission standards. know the water quality analysis. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | 1 | - | 2 | 3 | 3 | 2 | 2 | - | 3 | 2 | 1 |
| **CO2** | 2 | - | - | - | - | 2 | - | - | 2 | - | 1 | 2 | 3 | 2 | 2 |
| **CO3** | 2 | 3 | 3 | - | 1 | - | - | 2 | 1 | - | - | - | - | 2 | 2 |
| **CO4** | 2 | 2 | 3 | - | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 2 | 2 |
| **CO5** | - | - | 2 | 2 | - | 2 | - | - | 2 | - | 2 | - | 2 | 2 | 2 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **AIR POLLUTION:** Sampling and analysis of air pollutants, conversion of ppm into µg/m3. Definition of terms related to air pollution and control, classification of air pollutants - secondary pollutants - Indoor air pollution - Climate Change and its impact - Carbon Trade. |
| **UNIT-II** | **THERMODYNAMICS AND KINETICS OF AIR-POLLUTION:** Applications in the removal of gases like SOx, NOx, CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution. Odour pollution control. |
| **UNIT-III** | **METEOROLOGY AND AIR POLLUTION:** Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behavior and Air Quality - Wind rose diagrams, Plume Rise Models. |
| **UNIT-IV** | **AMBIENT AIR QUALITY MANAGEMENT:** Monitoring of SPM, $SO_2$; NOx and CO - Stack Monitoring for flue gases - Micro-meteorological monitoring - Weather Station. Emission Standards-Gaussian Model for Plume Dispersion. |
| **UNIT-V** | **AIR POLLUTION CONTROL & METHODS**: Control of particulates – Control at Sources, Process Changes, Design and operation of control Equipments – Settling Chambers, Cyclone separators –Fabric filters– scrubbers, Environmental friendly fuels - In-plant Control Measures, process changes, methods of removal and recycling. |

| TEXT BOOKS | |
|---|---|
| **1.** | Air Pollution by M.N. Rao and H.V.N. Rao – Tata McGraw Hill Company. |
| **2.** | Air Pollution and Control by KVSG Murali Krishna, Laxmi Publications, NewDelhi. |
| **REFERENCE BOOKS** | |
| **1.** | An Introduction to Air pollution by R.K. Trivedy and P.K. Goel, B.S. Publications. |
| **2.** | Air pollution by Wark and Warner - Harper & Row, NewYork. |
| **WEB REFERENCES** | |

| | |
|---|---|
| **1.** | **www.nptel.ac.in/courses** |

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|---|---|---|---|---|---|---|
| **Dr. P. Subba Rao** | **Dr. D. Rama Seshu** | **Dr. D. S Murthy** | **Mr. M. Sandeep** | **Mr. V. Manideep** | **Mr. A. Raviteja** | **Mr. A. Roger Antony** |

## PROFESSIONAL ELECTIVE-II: ADVANCED STRUCTURAL ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T34 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Familiarize Students with Raft Foundations and Retaining walls. |
| **2** | Equip student with concepts of design of different types of RCC water tanks. |
| **3** | Understand Concepts of flat slabs. |
| **4** | Understand the concepts and design procedures of Chimney. |
| **5** | Understand different types of transmission towers. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Design raft foundations and different types of RCC retaining walls. |
| **CO2** | Carryout analysis and design of different types of RCC water tanks. |

| | |
|---|---|
| **CO3** | Carryout analysis and Design of Flat Slabs. |
| **CO4** | Solve the problems design of Chimney. |
| **CO5** | Listout various types of transmission towers. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO2** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO3** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO4** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |
| **CO5** | 2 | 2 | 3 | -- | 1 | 1 | -- | -- | -- | -- | 2 | -- | 3 | 1 | 1 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **ANALYSIS AND DESIGN OF RAFT FOUNDATIONS:** Design of RCC Retaining walls: Cantilever and Counter fort. |
| **UNIT-II** | **ANALYSIS AND DESIGN OF RCC WATER TANKS**: Circular and Rectangular types- Intze tank including staging. |
| **UNIT-III** | **ANALYSIS AND DESIGN OF FLAT SLABS**: Direct Design and Equivalent Frame Methods- Check for Punching shear. |
| **UNIT-IV** | **CHIMNEY:** Analysis and Design of Chimney, Concepts of loading. |
| **UNIT-V** | **TRANSMISSION TOWERS:** Introduction to Steel Transmission Towers - Principles and procedures. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | "Reinforced Concrete Structures" Vol. - 2 by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications Pvt. Ltd., NewDelhi. |
| **2.** | "Reinforced Concrete Structures" by N. Subrahmanian, Oxford Publishers. |
| | |
| **REFERENCE BOOKS** | |
| **1.** | "Essentials of Bridge Engineering" by D. Johnson Victor, Oxford and IBM publication Co., Pvt.Ltd. |
| **2.** | "Reinforced concrete design" by S. U. Pillai and D. Menon, Tata Mc.Grawhill Publishing Company. |
| **3.** | "Design Drawing of Concrete and Steel Structures" by N. Krishna Raju, University Press 2005. |
| **4.** | Codes: Relevant IS: codes. |

## INTERNAL EXAMINATION PATTERN:

The total internal marks (40) are distributed in two components as follows:

1. Descriptive (subjective type) examination: 30marks
2. Assignment: 10marks

## FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is60%.

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## PROFESSIONAL ELECTIVE-II: PAVEMENT ANALYSIS & DESIGN

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T35 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| COURSE OBJECTIVES | |
|---|---|
| **1** | To know various factors affecting pavement design. |
| **2** | To know various concepts for the stresses in pavements and to understand material characterization. |
| **3** | To acquire design principles of flexible and rigid pavements |
| **4** | To acquire design principles of shoulders, overlays and drainage |
| **5** | To know highway capacity and level of service concepts. |

| COURSE OUTCOMES | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain concepts and standards adopted in Planning, Design and construction of Pavements. |
| **CO2** | Apply the knowledge of science and engineering fundamentals in designing flexible pavement by adopting various design standards. |
| **CO3** | Apply the standards adopted in designing rigid pavement. |
| **CO4** | Select appropriate methods for construction and evaluation of Pavements. |
| **CO5** | Address the problem statement in construction of pavement and to impart knowledge in stabilization techniques. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | 2 | - | 3 | - | 1 | - | - | 3 | 2 | - |
| **CO2** | - | - | 3 | - | 2 | 2 | - | - | - | 1 | - | 2 | 3 | 3 | 1 |
| **CO3** | - | 3 | 3 | 2 | 3 | - | - | - | 3 | 2 | 2 | 3 | 3 | 3 | 1 |
| **CO4** | - | 3 | 2 | 2 | 2 | - | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | - | 2 | 1 | 1 | 2 | - | 1 | 3 | 3 | 1 | 3 | 3 | 2 | 1 | 2 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **PAVEMENT TYPES AND STRESS DISTRIBUTION**<br>Introduction – Pavement as layered structure – Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading. |
| **UNIT-II** | **DESIGN OF FLEXIBLE PAVEMENTS**<br>Flexible pavement design Factors influencing design of flexible pavement, Empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads. |
| **UNIT-III** | **DESIGN OF RIGID PAVEMENTS**<br>Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India. |

| | |
|---|---|
| **UNIT-IV** | **PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE**<br>Construction of pavements – Construction Equipment - Methods of construction. Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index - Pavement maintenance (IRC Recommendations only). |
| **UNIT-V** | **STABILIZATION OF PAVEMENTS**<br>Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geo-synthetics in roads. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Khanna, S.K. and Justo C.E.G. and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition, 2014. |
| **2.** | Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley 2000. |
| **REFERENCE BOOKS** | |
| **1.** | Guidelines for the Design of Flexible Pavements,IRC-37–2012,The Indian roads Congress, New Delhi |
| **2.** | Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/syllabus/syllabus.php?subjectId=105105044 |
| **2.** | http://nptel.ac.in/syllabus/syllabus.php?subjectId=105107064 |

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## PROFESSIONAL ELECTIVE-II: MUNICIPAL SOLID WASTE MANAGEMENT

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T36 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Knowledge on characteristics of municipal solid wastes. |
| **CO2** | Planning on Reduction, reuse and recycling of waste. |
| **CO3** | Ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste. |

| | |
|---|---|
| **CO4** | Knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context. |
| **CO5** | Design and operation of sanitary landfill. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | 2 | - | 2 | - | 1 | 2 | - | - | - |
| **CO2** | 3 | - | 2 | - | 1 | - | 2 | 2 | 1 | - | - | 2 | 2 | - | - |
| **CO3** | 2 | 1 | 2 | 2 | - | 2 | 3 | - | 2 | - | 1 | 2 | 1 | 2 | - |
| **CO4** | 3 | - | 2 | - | 1 | - | 2 | 2 | 1 | - | 1 | 2 | - | - | 1 |
| **CO5** | 2 | 1 | - | - | - | - | 3 | - | 2 | - | 1 | 2 | 1 | 2 | 1 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **SOURCES AND TYPES**<br>Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness. |
| **UNIT-II** | **ON-SITE STORAGE AND PROCESSING**<br>On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling. |
| **UNIT-III** | **COLLECTION AND TRANSFER**<br>Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving. |
| **UNIT-IV** | **OFF-SITE PROCESSING**<br>Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and bio-methanation; Thermal processing options – case studies under Indian conditions. |

| | |
|---|---|
| **UNIT-V** | **DISPOSAL**<br>Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993. |
| **2.** | Vesilind, P.A. and Rimer, A.E., "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981 |
| **REFERENCE BOOKS** | |
| **1.** | Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000 |
| **2.** | Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001 |
| **3.** | Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000 |

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|---|---|---|---|---|---|---|
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## PROFESSIONAL ELECTIVE-II: GROUND WATER DEVELOPMENT

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T37 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| COURSE OBJECTIVES | |
|---|---|
| **1** | Appreciate groundwater as an important natural resource. |
| **2** | Understand flow towards wells in confined and unconfined aquifers. |
| **3** | Understand the principles involved in design and construction of wells. |
| **4** | Create awareness on improving the groundwater potential using various recharge techniques. |
| **5** | Know the importance of saline water intrusion in coastal aquifers and its control measures. |

| COURSE OUTCOMES | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers |
| **CO2** | Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics |
| **CO3** | Explain the concept of groundwater model development and data base management for groundwater management |
| **CO4** | Describe the importance of artificial recharge and groundwater quality concepts |
| **CO5** | Apply the creative and innovative technique on conservation of groundwater |

**Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | - | 1 | 1 | 2 | 3 | - | - | 1 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | - | 2 | 2 | 2 | 3 | - | - | 2 | 2 | 2 | 3 | 2 |
| **CO3** | 2 | 2 | 3 | - | 3 | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 | - | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **HYDROGEOLOGICAL PARAMETERS**<br>Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer assumption – Steady Radial Flow into a Well |
| **UNIT-II** | **WELL HYDRAULICS**<br>Unsteady state flow – The is method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery |

| | |
|---|---|
| **UNIT-III** | **GROUNDWATER MANAGEMENT**<br>Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty Development of a model |
| **UNIT-IV** | **GROUNDWATER QUALITY**<br>Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water – Industrial water – Irrigation water - Ground water Pollution and legislation - Environmental Regulatory requirements |
| **UNIT-V** | **GROUNDWATER CONSERVATION**<br>Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010. |
| **2.** | Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000. |
| **REFERENCE BOOKS** | |
| **1.** | Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015. |
| **2.** | Rastogi A.K. , Numerical Groundwater Hydrology, 2011 |

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|---|---|---|---|---|---|---|
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## PROFESSIONAL ELECTIVE-II: REMOTE SENSING & GIS APPLICATIONS

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE7T38 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Introduce the basic principles of Remote Sensing and GIS techniques. |
| **2** | Learn various types of sensors and platforms. |
| **3** | Learn concepts of visual and digital image analyses. |
| **4** | Understand the principles of spatial analysis. |
| **5** | Appreciate application of RS and GIS to Civil engineering. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Interpret the concepts of Photogrammetric and its applications such as determination of heights of objects on terrain. |
| **CO2** | Illustrate the Electromagnetic spectrum and utilize the energy interactions of EMR with atmosphere and earth surface features for GIS data generation |
| **CO3** | Analyze the methods of map projections and understand coordinate systems on GIS Software packages to produce high resolution thematic maps. |
| **CO4** | Apply the concepts of vector and raster data model for representation of topological earth features and its importance. |
| **CO5** | Apply the RS & GIS techniques for solving civil engineering applications |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 2 | 1 | 1 | 1 | 2 | 2 | - | 1 | - | - | 2 | - | 2 | - | 1 |
| **CO2** | 2 | 1 | 1 | 1 | 2 | 2 | - | 1 | - | - | 2 | - | 2 | - | 1 |
| **CO3** | 2 | 2 | - | 2 | 2 | 2 | - | 1 | - | - | 2 | - | 2 | - | 1 |
| **CO4** | 2 | 2 | 1 | 2 | 2 | 2 | - | 1 | - | - | 2 | - | 2 | - | 1 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 2 | 3 | 1 | 3 | 2 | 3 | - | 1 | - | - | 2 | - | 2 | - | 1 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **INTRODUCTION TO REMOTE SENSING:** Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces characteristics of remote sensing systems.<br>**SENSORS AND PLATFORMS:** Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line |
| **UNIT-II** | **IMAGE ANALYSIS:** Introduction, elements of visual interpretations, digital image processing- image pre-processing, image enhancement, image classification, supervised classification, unsupervised classification. |
| **UNIT-III** | **GEOGRAPHIC INFORMATION SYSTEM (GIS):** Introduction, key components, application areas of GIS, map projections. Data entry and preparation: spatial data input, raster data models, vector data models. |
| **UNIT-IV** | **SPATIAL DATA ANALYSIS:** Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing. |
| **UNIT-V** | **RS AND GIS APPLICATIONS GENERAL:** Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications<br>**APPLICATION TO HYDROLOGY AND WATER RESOURCES:** Flood zoning and mapping, groundwater prospects and potential recharge zones, watershed management. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Bhatta B (2008), “Remote sensing and GIS”, Oxford University Press. |
| **2.** | Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) “Remote Sensing and Image Interpretation”, Wiley India Pvt. Ltd., NewDelhi |
| **REFERENCE BOOKS** | |
| **1** | Remote Sensing and its Applications“ by Narayan LRA, Universities Press,2012. |
| **3** | Fundamentals of Remote Sensing“ by George Joseph, Universities Press,2013. |
| **4** | Fundamentals of Geographic Information Systems“ by Demers, M.N, Wiley India Pvt. Ltd,2013 |
| **5** | Basics of Remote sensing & GIS“ by Kumar S, Laxmi Publications, New Delhi, 2005. |
| **6** | Principals of Geographical Information Systems“ by Burrough P A and R.A. McDonnell, Oxford University Press,1998. |
| **WEB REFERENCES** | |
| | **www.nptel.ac.in/courses** |

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# DETAILING AND DRAWING OF CIVIL ENGINEERING STRUCTURES

| **Course Category** | Professional Core | **Course Code** | 19CE7L11 |
|---|---|---|---|
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To enhance the students knowledge and skills in Irrigation drawing. |
| **2** | To know all the design of irrigation structures |
| **3** | To design the surplus weir, canal regular |
| **4** | To detail the reinforced structures |
| **5** | To give basic idea about all Irrigation structural components |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Able to know all the design of irrigation structures. |
| **CO2** | Design the surplus weir, canal regular, Tank Sluice and Direct Sluice. |
| **CO3** | Basically idea about all reinforced structural components. |
| **CO4** | Basically idea about all Steel structural components. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 2 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | 2 | 2 | - |
| **CO2** | 2 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | 2 | 2 | - |
| **CO3** | 2 | 2 | 3 | 2 | - | - | - | - | 1 | - | - | - | 2 | 2 | - |
| **CO4** | 2 | 2 | 3 | 2 | - | - | - | - | 1 | - | - | - | 2 | - | - |
| **CO5** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| **1.** | **IRRIGATION STRUCTURES:**<br>**a) TANK COMPONENTS**<br>Fundamentals of design – Tank surplus weir – Tank sluice with tower head – Drawings showing foundation details, plan and elevation.<br>**b) IMPOUNDING STRUCTURES**<br>Design principles – Earth dam – Profile of Gravity Dam<br>**c) CROSS DRAINAGE WORKS**<br>General design principles – Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) Drawing showing plan, elevation and foundation details. |

| | |
|---|---|
| | **d) CANAL REGULATION STRUCTURES**<br>General Principles – Direct Sluice – Canal regulator – Drawing showing detailed plan, elevation and foundation details. |
| **2.** | **REINFORCED CONCRETE STRUCTURES:**<br>Drawing showing detailed longitudinal section and cross-section of<br>**a)** Beams<br>**b)** Columns<br>**c)** Footings<br>**d)** Slabs<br>**e)** Staircases |
| **3.** | **STEEL STRUCTURES:**<br>Drawing showing detailed sections of<br>**a)** Roof Trusses |

| **S NO.** | **LIST OF EQUIPMENTS** |
|---|---|
| **1** | Drawing Tables. |
| **2** | Drafters with Clips. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | A text book Water Resources Engineering (principles and practice) by Satya Narayana Murty Challa by New Age International publishers. |
| **2.** | Garg, S.K., "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 1997 |
| **3.** | Limit State Design by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | Sharma R.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 2002 |
| **2.** | Raghunath, H.M. "Irrigation Engineering", Wiley India Pvt. Ltd., New Delhi, 2011. |

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## GIS & STAAD Pro LABORATORY

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE7L12 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | ------ | **Internal Assessment** | 30 |

| | | | |
|---|---|---|---|
| | | **Semester End Examination**<br>**Total Marks** | 70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Introduce image processing and GIS software. |
| **2** | Familiarize structural analysis software. |
| **3** | Understand the process of digitization, creation of thematic map from toposheets and maps |
| **4** | Learn to apply GIS software to simple problems in water resources and transportation engineering. |
| **5** | Learn to analyze and design retaining wall and simple towers. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Digitize and create thematic map and extract important features using GIS software. |
| **CO2** | Analyze and Interpret the maps created using GIS for specific applications. |
| **CO3** | Use structural analysis software to analyze and design 2D and 3D frames |

**Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | 3 | 1 | 1 |
| **CO2** | 2 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | 3 | 1 | 1 |
| **CO3** | 2 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | 3 | 1 | 1 |

| **S NO** | **LIST OF EXPERIMENTS** |
|---|---|
| | **Exercises in GIS:** |
| **1** | Digitization of Map/Toposheets. |
| **2** | Creation of thematic maps. |
| **3** | Estimation of features and interpretation. |
| **4** | Developing Digital Elevation model. |
| **5** | Simple applications of GIS in water Resources Engineering & Transportation Engineering |
| | **Exercises in STAAD:** |
| **6** | 2-D Frame Analysis and Design |
| **7** | Steel Tabular Truss Analysis and Design |
| **8** | 3-D Frame Analysis and Design |
| **9** | Retaining Wall Analysis and Design |
| **10** | Simple Tower Analysis and Design |

| S NO. | LIST OF EQUIPMENTS |
|---|---|
| | **GIS SOFTWARES:** |
| **1** | Arc GIS9.0 |
| **2** | ERDAS8.7 |
| **3** | MapInfo6.5 |
| **4** | Any one or Equivalent. |
| | **STAAD SOFTWARES:** |
| **5** | STAAD PRO /Equivalent |
| **6** | STRAP |
| **7** | STRUDS |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Concept and Techniques of GIS‟ by C.P.L.O. Albert, K.W. Yong, Printice Hall Publishers. |
| **2.** | Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) “Remote Sensing and Image Interpretation”, Wiley India Pvt. Ltd., NewDelhi |
| **REFERENCE BOOKS** | |
| **1.** | Staad Pro V8i for Beginners: With Indian Examples by T.S.Sarma |
| **2.** | Verification Manual of Respective Software |

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# CONSTRUCTION TECHNOLOGY & MANAGEMENT

| | | | |
|---|---|---|---|
| **Course Category** | Professional core | **Course Code** | 19CE8T39 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce to the student the concept of project management including network drawing and monitoring. |
| **2** | To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery. |
| **3** | To introduce the importance of safety in construction projects. |
| **4** | To introduce the importance of Man power in Construction projects. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Apply the project management techniques for construction planning |
| **CO2** | Apply the project management for Solve and upgrade the PERT Technique by using resources in construction |
| **CO3** | Plan the suitable equipments in various tasks of civil engineering projects. |
| **CO4** | Apply the safety requirements and quality control aspects in projects |
| **CO5** | Planning of Man power and Plan the suitable construction methods for the site execution. |

| **Contribution of Course Outcomes towards achievement of program** |
|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 1 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **CONSTRUCTION PROJECT MANAGEMENT AND ITS RELEVANCE**– qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method. |
| **UNIT-II** | **PROJECT EVALUATION AND REVIEW TECHNIQUE**– cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources. |
| **UNIT-III** | **CONSTRUCTION EQUIPMENT**– economical considerations – earthwork equipment– Trucks and handling equipment – rear dump trucks – capacities of trucks. Handling equipment – calculation of truck production – compaction equipment – types of compaction rollers.<br>**HOISTING AND EARTHWORK EQUIPMENT**– hoists – cranes – tractors - bulldozers – graders – scrapers– draglines -clamshell buckets. |
| **UNIT-IV** | **CONCRETING EQUIPMENT**– crushers – jaw crushers – rotary crushers – impact crushers – selection of crushing equipment - screening of aggregate – concrete mixers – mixing and placing of concrete – consolidating and finishing. |
| **UNIT-V** | **CONSTRUCTION METHODS**– earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. Man power planning in construction projects. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Construction Planning, Equipment and Methods by Peurifoy and Schexnayder, Shapira, Tata M c Graw hill. |
| **2.** | Construction Project Management Theory and Practice by Kumar NeerajJha (2011), Pearson. |
| **REFERENCE BOOKS** | |
| **1.** | Construction Project Management - An Integrated Approach by Peter Fewings, Taylor and Francis. |
| **2.** | Construction Management Emerging Trends and Technologies by Trefor Williams, Cengage learning. |
| **3.** | Construction Technology by Subir K. Sarkar and SubhajitSaraswati, Oxford University press. |
| **4.** | Construction project management By K. K CHITKARA,Tata M c Graw hill. |

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# PRESTRESSED CONCRETE

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE8T40 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Concrete technology and Designing and detailing of reinforced concrete structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Familiarize Students with concepts and with different systems used in prestressing concrete. |
| **2** | Understand the different losses of pre-stress including short and long term losses. |
| **3** | Familiarize students with the analysis and design of prestressed concrete members under flexure. |
| **4** | Familiarize students with the analysis and design of prestressed concrete members under shear and torsion. |
| **5** | To be able to understand the major difference between R.C.C Design and P.S.C Design. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Perceive the different methods of prestressing. Analyze and design prestressed concrete beams under flexure and shear Resistance. |
| **CO2** | Listout the various losses in prestressed concrete systems. |
| **CO3** | Design prestressed concrete beams under flexure. |

| | |
|---|---|
| **CO4** | Design prestressed concrete beams under shear and torsion and interpret the relevant IS code provisions for prestressed concrete. |
| **CO5** | Design of end zone reinforcement. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | -- | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | -- | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | -- | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | -- | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | -- | 3 | 3 | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **INTRODUCTION:** Historic development – General principles of prestressing, pretensioning and post tensioning – Advantages and limitations of prestressed concrete – Materials – High strength concrete and high tensile steel their characteristics. I.S.Code provisions, Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of prestressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System. |
| **UNIT-II** | **ANALYSIS OF SECTIONS FOR FLEXURE:** Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons. Concept of load balancing method, pressure line (Trust), Cracking moment for mid and end support conditions.<br>**LOSSES OF PRESTRESS:** Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses. |
| **UNIT-III** | **DESIGN FOR FLEXURAL RESISTANCE:** Design for Flexural resistance- Types of flexural failure – Code procedures-Design of sections for flexure- Control of deflections- Factors influencing- Prediction of short term and long term deflections. |
| **UNIT-IV** | **DESIGN FOR SHEAR AND TORSION**: Shear and Principal Stresses: Design of Shear reinforcements- Codal Provisions- Design for Torsion, Design for Combined bending, shear and torsion. |
| **UNIT-V** | **TRANSFER OF PRE-STRESS**<br>Transfer of Prestress in pre-tensioned members- Transmission length- Bond stresses- End zone reinforcement- Codal provisions- Anchorage zone stresses in Post tensioned members- Stress distribution in End block- Anchorage Zone reinforcement. |

**TEXT BOOKS**

| | |
|---|---|
| **1.** | "Prestressed Concrete" by N. Krishna Raju, Mc Grawhill Education: 6th Edition, 2018 |
| **2.** | "Prestressed Concrete" by S. Ramamrutham, Dhanpat Rai publishing company |

**REFERENCE BOOKS**

| | |
|---|---|
| **1.** | "Prestressed Concrete" by P. Dayaratnam, Medtech: 7th Edition, 2017 |
| **2.** | "Prestressed Concrete" by T. Y. Lin & Burns, Wiley Publications. |

**WEB REFERENCES**

| | |
|---|---|
| **1.** | http://freevideolectures.com/Course/94/Prestressed-Concrete-Structures |

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## PROFESSIONAL ELECTIVE - III: SOIL DYNAMICS & MACHINE FOUNDATION

| | | | |
|---|---|---|---|
| **Course Category** | Professional elective | **Course Code** | 19CE8T41 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

**RAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To understand the basics of dynamics – dynamic behavior of soils – effects of dynamic loads and the various design methods. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | The basic knowledge about the theory of vibration. |
| **CO2** | Listout the different types of waves and its behavior. |
| **CO3** | Determining various laboratory and field tests to determine |
| **CO4** | Assess the contamination in the soil and to select suitable remediation methods |
| **CO5** | Assess the influence of vibrations and selection of remediation methods based |

**Contribution of Course Outcomes towards achievement of program Outcomes (1-Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | | 2 |
| **CO2** | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 3 |
| **CO5** | 3 | 1 | 3 | 2 | 1 | 1 | 1 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **THEORY OF VIBRATION**<br>Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads |
| **UNIT-II** | **WAVE PROPAGATION**<br>Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compression wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typical values – Particle movements and velocity. |
| **UNIT-III** | **DYNAMIC PROPERTIES OF SOILS**<br>Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure |
| **UNIT-IV** | **FOUNDATION FOR DIFFERENT TYPES OF MACHINES**<br>Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions. |

| | |
|---|---|
| **UNIT-V** | **INFLUENCE OF VIBRATION AND REMEDIATION**<br>Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt.Ltd. (Second Edition) 2006, (Reprint 2010), NewDelhi-110002 |
| **2.** | Srinivasulu. P, and Vaidyanathan. C. V, "Handbook of Machine Foundations", Tata McGraw-Hill, 2007 |
| **REFERENCE BOOKS** | |
| **1.** | Kamaswara Rao., "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi,1998. |
| **2.** | Kameswara Rao., "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003. |
| **3.** | Moore, P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH,2005 |
| **4.** | Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall,2014. |

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## PROFESSIONAL ELECTIVE - III: BRIDGE ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE8T42 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Familiarize Students with different types of Bridges and IRC standards. |
| **2** | Equip student with concepts and design of Slab Bridges, T Beam Bridges, Box Culverts |
| **3** | Understand concepts of design of Plate Girder Bridges. |
| **4** | Familiarize with different methods of inspection of bridges and maintenance. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Listout the types of Bridges with diagrams and Loading standards. |
| **CO2** | Design of Slab bridges and suggest structural detailing. |

| | |
|---|---|
| **CO3** | Design of T beam bridge. |
| **CO4** | Design of Plate girder bridges, box culverts and suggest structural detailing. |
| **CO5** | Organize for attending inspections and maintenance of bridges and prepare reports. |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | 2 | - | 2 | - | - | 3 | - | 2 | - | 3 |
| **CO2** | 3 | 3 | 2 | - | - | 2 | - | 2 | - | - | 3 | - | 2 | - | 3 |
| **CO3** | 3 | 3 | 2 | - | - | 2 | - | 2 | - | - | 3 | - | 3 | - | 3 |
| **CO4** | 3 | 3 | 2 | - | - | 2 | - | 2 | - | - | 3 | - | 2 | - | 3 |
| **CO5** | 3 | 2 | 2 | - | - | 2 | - | 2 | - | - | 3 | - | 2 | - | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **INTRODUCTION**- Bridges- Types- Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, prestressed concrete bridges, Truss Bridges, Culverts, - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading. |
| **UNIT-II** | **SLAB BRIDGES**- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Guyon‟s – Massonet Method –Hendry- Jaegar Methods- Courbon‟s theory- Pigeaud‟s method. |
| **UNIT-III** | **T-BEAM BRIDGES**- Analysis and design of various elements of bridge –Design of deck slab, longitudinal girders, and Secondary beams- Reinforcement detailing. |
| **UNIT-IV** | **PLATE GIRDER BRIDGES:** Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.<br>**BOX CULVERTS:** Loading –Analysis and Design- Reinforcement detailing. |
| **UNIT-V** | **INSPECTION AND MAINTENANCE OF BRIDGES**: Procedures and methods for inspection – Testing of bridges- Maintenance of Sub Structures and Superstructures- Maintenance of bearings- Maintenance Schedules. |

| TEXT BOOKS | |
|---|---|
| **1.** | "Essentials of Bridge Engineering" by Jhonson Victor D, Oxford, 6th Edition 2019. |
| **2.** | "Design of Bridge Structures" by T. R. Jagadeesh, M.A. Jayaram,PHI, 2nd edition, 2009. |
| **REFERENCE BOOKS** | |
| **1.** | "Bridge Engineering" by S Ponnuswamy, 3rd Edition, Mc Graw Hill education, 2017 |
| **2.** | "Design of Bridges" by Krishna Raju, 4th edition by worldwide book store, NewDelhi. |

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## PROFESSIONAL ELECTIVE - III: TRAFFIC ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE8T43 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| COURSE OBJECTIVES | |
|---|---|
| **1** | To know various components and characteristics of traffic. |
| **2** | To know various traffic control devices and principles of highway safety. |
| **3** | To understand the detrimental effects of traffic on environment. |
| **4** | To know highway capacity and level of service concepts. |
| **5** | To learn about intelligent vehicle highway systems. |

| COURSE OUTCOMES | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Discover Parking Problems and manage traffic regulations. |
| **CO2** | Determine traffic speed, volume, travel time and Density. |
| **CO3** | Design traffic signals. |

| | |
|---|---|
| **CO4** | Discover traffic-environment problems. |
| **CO5** | Build Knowledge of traffic Capacity and Level of service and developing vehicle highway systems. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | - | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO2** | - | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO3** | - | - | 3 | 3 | - | - | - | - | - | - | - | - | 1 | 2 | - |
| **CO4** | - | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | - | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **COMPONENTS OF THE TRAFFIC SYSTEM:** Human-Vehicle–Environment System; characteristics of Road users, Vehicles, Highways and their classification; Traffic Studies: Inventories; Volume studies; Speed, Travel time and Delay studies; Intersection studies; Pedestrian studies; Parking studies; Accident studies. Types of parking facilities – On street parking and Off-street Parking facilities; Parking studies and analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of parking parameters; Parking accumulation, Parking Load, Parking Turnover, Parking Volume, Parking Index. |
| **UNIT-II** | **TRAFFIC CHARACTERISTICS:** Microscopic and macroscopic flow characteristics: Time headways; Temporal, spatial and model flow patterns; Interrupted and Un interrupted traffic. Microscopic and macroscopic speed characteristics: Vehicular speed Trajectories; Speed characteristics – Mathematical distribution; Speed and travel time variations; Travel time and delay studies. Microscopic and Macroscopic density characteristics: Distance headway characteristics; Car-following theories; Density measurement techniques; Density contour maps. |
| **UNIT-III** | **TRAFFIC CONTROL DEVICES & HIGHWAY SAFETY:** Traffic signs & Markings; Signal Warrants; Signal phasing and Development of phase plans; Fixed and Vehicle activated signals; Webster method; ARRB method; Drew's Method; IRC method; Signal coordination; Area Traffic control. Accident characteristics – Road – Driver – Vehicle; Accident recording and Analysis; Highway Safety Improvement Program; Safety Audit. |
| **UNIT-IV** | **ENVIRONMENTAL CONSIDERATIONS:** Air pollution: Kinds of pollutants; Air pollution standards; Measures of air quality; modelling and control. Noise pollution: Measurement of sound levels; Acceptable limits, Prediction of noise levels, Traffic noise control. Measures to curtail environmental degradation due to traffic. |
| **UNIT-V** | **HIGHWAY CAPACITY AND LEVEL OF SERVICE:** Capacity and level of service; Factors affecting Capacity and LOS; Capacity of Rural Highways, Capacity of Urban Roads; HCM and IRC standards.<br>**INTELLIGENT VEHICLE – HIGHWAY SYSTEMS:** Traffic surveillance and monitoring; IVHS programs, Role of IVHS, IVHS categories, Benefits and Costs of IVHS. |

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| **TEXT BOOKS** | |
| **1.** | "Traffic Engineering: Theory and Practice" by Pignataro LJ., Prentice hall, Inc. |
| **2.** | "Traffic and Transport planning" by Kadiyali L.R., Khanna Publishers. |
| **REFERENCE BOOKS** | |
| **1.** | "Traffic Engineering Hand Book" by Institute of Transportation Engineers, 4 Ed., Prentice Hall. |
| **2.** | "Traffic Engineering" by Mc Shane, WR and RP Roess, Prentice Hall. |
| **WEB REFERENCES** | |
| **1.** | http://nptel.ac.in/courses/105101008/12 |

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## PROFESSIONAL ELECTIVE - III: EARTHQUAKE ENGINEERING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective-III | **Course Code** | 19CE8T44 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

**COURSE OBJECTIVES**

| | |
|---|---|
| **1** | Familiarize Students with Engineering Seismology. |
| **2** | Understand Concepts of Seismic Design. |
| **3** | Familiarize with Design philosophies for Seismic loading. |
| **4** | Familiarize students with various IS codal provisions for ductile design and detailing. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain fundamentals of Engineering Seismology. |
| **CO2** | Solve SDOF Systems and suggest ductile design. |
| **CO3** | Compute equivalent lateral seismic loads and carryout a seismic design as per IS codal provisions. |
| **CO4** | Seismic Analysis and design of simple 2-storied RC Building frame. |
| **CO5** | Draw ductile detailing of flexural members as per IS 13920. |

| **Contribution of Course Outcomes towards achievement of program** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcomes (1 - Low, 2- Medium, 3-High)** | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 1 | -- | -- | -- | 2 | -- | 2 | 1 | -- | -- | 3 | 1 | -- |
| **CO2** | 3 | 2 | 1 | -- | -- | -- | 2 | -- | 1 | -- | -- | -- | 3 | 1 | -- |
| **CO3** | 3 | 2 | 1 | -- | -- | -- | -- | -- | -- | 1 | -- | -- | 3 | 2 | -- |
| **CO4** | 3 | 2 | 1 | -- | -- | -- | 2 | -- | -- | -- | -- | -- | 3 | 1 | -- |
| **CO5** | 3 | 2 | 1 | -- | -- | -- | 2 | -- | -- | 3 | -- | -- | 3 | 3 | -- |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **ENGINEERING SEISMOLOGY** – rebound theory – plate tectonics – seismic waves - Earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects. |
| **UNIT-II** | **SEISMIC DESIGN CONCEPTS** – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF - Infill wall – Non-structural elements. |
| **UNIT-III** | **CALCULATION OF EQUIVALENT LATERAL FORCE**- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method. |
| **UNIT-IV** | **DESIGN AND DUCTILE DETAILING OF BEAMS AND COLUMNS OF FRAMES** - Concept of strong column weak beams, Ductility criteria for earthquake resistant design, Ductile detailing of flexural members as per IS 13920- Longitudinal reinforcement, Shear reinforcement, Anchorage of reinforcement-Development length, Lap Splices. |
| **UNIT-V** | **SEISMIC ANALYSIS AND DESIGN**: simple 2-storied RC Building frame – Equivalent static lateral force method and response spectrum method. |

| TEXT BOOKS | |
|---|---|
| **1.** | "Earthquake Resistant Design of Structures"- Pankaj Agarwal and Manish Shri Khande, Prentice – Hall of India, 2007, NewDelhi. |
| **2.** | "Earthquake Resistant Design of Building Structures" by Vinod Hosur,Wiley India Ltd. |
| **REFERENCE BOOKS** | |
| **1.** | "Introduction to the Theory of Seismology" by Bullen K.E.,Great Britain at the University Printing houses, Cambridge University Press1996. |
| **2.** | Relevant code of practices. |

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## PROFESSIONAL ELECTIVE – III: WATER RESOURCE SYSTEM PLANNING

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 19CE8T45 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| COURSE OBJECTIVES | |
|---|---|
| **1** | To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally |
| **2** | Appreciate mathematical optimization methods and models. |
| **3** | Learn and apply basic economic analysis tools to water resources projects |
| **4** | Understand linear, nonlinear and dynamic programming techniques and apply them to various water resources systems planning and design problems |
| **5** | Appreciate simulation and management techniques in water resources systems. |

| COURSE OUTCOMES | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project. |
| **CO2** | Apply the concept of linear programming for optimisation of water resources problems. |
| **CO3** | Explain the concept of dynamic programming and apply in water resource System. |
| **CO4** | Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy. |
| **CO5** | Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management. |

**Contribution of Course Outcomes towards achievement of program**

| Outcomes (1 - Low, 2- Medium, 3-High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | - | - | - | - | - | 2 | - | - | - | - | 3 | 2 | 2 | 2 |
| **CO2** | 3 | 2 | - | - | - | 3 | - | 3 | - | - | 2 | 2 | 2 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | - | 2 | 2 | - | 2 | - | - | 3 | 2 | 1 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | - | 3 | 3 | - | 3 | - | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | 2 | - | 3 | 3 | 3 | 3 | 3 |

**COURSE CONTENT**

| | |
|---|---|
| **UNIT-I** | **SYSTEM APPROACH:**<br>Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering |
| **UNIT-II** | **LINEAR PROGRAMMING:**<br>Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir |
| **UNIT-III** | **DYNAMIC PROGRAMMING:**<br>Bellman's optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion. |
| **UNIT-IV** | **SIMULATION:**<br>Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir |
| **UNIT-V** | **ADVANCED OPTIMIZATION TECHNIQUES:**<br>Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010 |
| **2.** | Bhave PR, Water Resources Systems, Narosa Publishers, 2011 |
| **REFERENCE BOOKS** | |
| **1.** | Water resource system analysis – Vedula & Mujumdar – Tata Mc. Graw hillcompany Ltd.2005. |
| **2.** | Water resources Economics – James & Lee. Oxford publishers2005. |

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**RAGATI ENGINEERING COLLEGE: SURAMPALEM**
**(Autonomous R19)**

## PROFESSIONAL ELECTIVE - III: ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 19CE8T18 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ----- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To impart knowledge on different concepts of Environmental Impact Assessment. |
| **2** | To know procedures of risk assessment |
| **3** | To learn the EIA methodologies and the criterion for selection of EIA methods. |
| **4** | To pre-requisites for ISO 14001certification |
| **5** | To know the procedures for environmental clearances and audit |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Prepare EMP, EIS, and EIA report |
| **CO2** | Identify the risks and impacts of a project |
| **CO3** | Selection of an appropriate EIA methodology |
| **CO4** | Evaluate the EIA report |
| **CO5** | Estimate the cost benefit ratio of a project |

**Contribution of Course Outcomes towards achievement of program**

**Outcomes (1 - Low, 2- Medium, 3-High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | 1 | - | 2 | 3 | 3 | 2 | 2 | - | 3 | 2 | 1 |
| **CO2** | 2 | - | - | - | - | 2 | - | - | 2 | - | 1 | 2 | 3 | 2 | 2 |
| **CO3** | 2 | 3 | 3 | - | 1 | - | - | 2 | 1 | - | - | - | - | 2 | 2 |
| **CO4** | 2 | 2 | 3 | - | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 2 | 2 |
| **CO5** | - | - | 2 | 2 | - | 2 | - | - | 2 | - | 2 | - | 2 | 2 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | **BASIC CONCEPT OF EIA:** Elements of EIA-factors affecting EIA-Initial environmental Examination-life cycle analysis preparation of Environmental Base map-Classification of environmental parameters – role of stakeholders in the EIA preparation –stages in EIA. |
| **UNIT-II** | **EIA METHODOLOGIES**: introduction, Criteria for the selection of EIA Methodology, EIA methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis - EIS and EMP. |
| **UNIT-III** | **IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE**: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives- application of remote sensing and GIS for EIA. |

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|---|---|
| **UNIT-IV** | **PROCUREMENT OF RELEVANT SOIL QUALITY**: Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - EIA with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment. |
| **UNIT-V** | **ASSESSMENT OF IMPACT OF DEVELOPMENT ACTIVITIES**: Vegetation and wildlife, environmental Impact of Deforestation EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, procedure for environmental clearance, evaluation of EIA report. Environmental legislation objectives, Evaluation of Audit data and preparation of Audit report. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Environmental Impact Assessment, Canter Larry W.,McGraw-Hill education Edi (1996) |
| **2.** | Environmental Impact Assessment Methodologies, by Y.Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad. |
| **REFERENCE BOOKS** | |
| **1.** | Environmental Science and Engineering, by J. Glynn and Gary W.HeinKe – Prentice Hall Publishers. |
| **2.** | Environmental Science and Engineering, by Suresh K.Dhaneja – S.K.Katania&Sons Publication, NewDelhi. |
| **3.** | Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd., NewDelhi. |
| **WEB REFERENCES** | |
| | **www.nptel.ac.in/courses** |

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