

SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur-603203.

Approved by AICTE, Affiliated to Anna University



UG - Curricula and Syllabi

B.E - Civil Engineering

Regulations 2023

VISION OF THE INSTITUTE

“Educate to excel in Social Transformation”

To accomplish and maintain international eminence and become a model institution for higher learning through dedicated development of minds, advancement of knowledge and professional application of skills to meet the global demands.

MISSION OF THE INSTITUTE

- To contribute to the development of human resources in the form of professional engineers and managers of international excellence and competence with high motivation and dynamism, who besides serving as ideal citizen of our country will contribute substantially to the economic development and advancement in their chosen areas of specialization.
- To build the institution with international repute in education in several areas at several levels with specific emphasis to promote higher education and research through strong institute industry interaction and consultancy.
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VISION OF THE DEPARTMENT

To produce competent and quality engineers by imparting knowledge, excellence and global perspectives in Civil Engineering to our students and to make them ethically strong professional engineers to build our nation.

MISSION OF THE DEPARTMENT

M1: To produce outstanding graduates with high technical knowledge to serve the nation.

M2: To impart value based education

M3: To provide solution to the challenges in the field of Civil Engineering.

1. PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

1. To prepare the students have successful careers in industry, Entrepreneur, Leadership, Communication skill and motivate for higher education.
2. To provide students with adequate technical knowledge and skills in using modern engineering tools to apply mathematics, science and engineering fundamentals to the modelling, analysis and solution of problems related to electrical and electronics engineering.
3. To provide an opportunity to work in interdisciplinary groups.
4. To promote student awareness for life-long learning and inculcate professional ethics.
5. To provide necessary foundation on computational platforms and software applications related to electrical engineering.

2. PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional

engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

1. PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Civil Engineering program the student will have following Program specific outcomes

1. Establish a Civil Engineering career in industry, government or academic field and achieve professional expertise as appropriate.
2. Execute innovation and excellence in Civil engineering problem solving and design in global and societal contexts.
3. Commit to lifelong learning and professional development in the Civil Engineering field to stay updated in technology, research topics and contemporary issues.
4. Understand the fundamentals of Civil Engineering in commercial contexts and in expediting construction projects.

2. PEO / PO Mapping:

| PROGRAMME EDUCATIONAL OBJECTIVES | PROGRAMME OUTCOMES | | | | | | | | | | | | PROGRAM SPECIFIC OUTCOMES | | | |
|----------------------------------|--------------------|---|---|---|---|---|---|---|---|----|----|----|---------------------------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| I | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 2 | 3 |
| II | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| III | 1 | | | 3 | 3 | 3 | 1 | 1 | 3 | | 3 | 1 | 3 | 3 | 3 | 2 |
| IV | 3 | | | 1 | 3 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Contribution: 1. Reasonable 2. Significant 3. Strong

| MAPPING: | | | | | | | | | | | | | | | | | | | |
|----------|-------------|--|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|---------------------------|------|------|------|-----|
| | | Subject code & Name | PROGRAMME OUTCOMES | | | | | | | | | | | | PROGRAM SPECIFIC OUTCOMES | | | | |
| | | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
| Year I | Semester I | Professional English - I | 2.2 | 2.6 | 2 | 2.0 | 2.0 | 0.0 | 2.0 | 0.0 | 0.0 | 2.8 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Matrices and Calculus | 3.0 | 2.0 | 2.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Engineering Physics | 2.8 | 1.4 | 1.4 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Engineering Chemistry | 2.8 | 1.8 | 2.2 | 1.2 | 1.0 | 1.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 1.0 | 0.0 | 0.0 | 0.0 |
| | | Basic Electrical and Electronics Engineering | 2.8 | 1.8 | 1.7 | 3.0 | 2.0 | 2.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.5 | 2.5 | 2.0 | 0.0 |
| | | தமிழர் மரபு / Heritage of Tamils | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Physics and Chemistry Laboratory | 3.0 | 2.4 | 2.6 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Engineering Practices Laboratory | 2.0 | 1.0 | 0.8 | 1.0 | 1.2 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| | | English Language Learning Laboratory | 3.0 | 2.0 | 2.3 | 2.0 | 2.3 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Year I | Semester II | Professional English - II | 1.6 | 1.2 | 1 | 1.3 | 2 | 0.0 | 2 | 0.0 | 0.0 | 2.8 | 0.0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Statistics and Numerical Methods | 2.0 | 2.0 | 1.4 | 2.0 | 2.0 | 0.0 | 2.0 | 0.0 | 0.0 | 2.8 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Physics for Civil Engineering | 1.8 | 1.8 | 1.5 | 1.8 | 2.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | 0.0 | |
| | | Chemistry for Construction Materials | 2.6 | 1.6 | 1.6 | 2 | 0.6 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | 0.8 | 0.4 | 0.2 |
| | | Problem solving and Python Programming | 2.6 | 2.4 | 2.2 | 1.8 | 1.7 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 1.5 | 0.0 | 0.0 | 0.0 |

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|---------------------------------------|--------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year I | Semester II | தமிழரும் தொழில் நுட்பமும் / Tamils and Technology | 2.2 | 2.4 | 3.0 | 2.7 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 2.0 | 2.0 | 0.0 | 2.0 | 1.0 |
| | | Engineering Graphics and Design | 2.0 | 0.0 | 3.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 3.0 | 0.0 | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 |
| | | Problem Solving and Python Programming Laboratory | 2.0 | 1.4 | 1.0 | 1.0 | 1.2 | 2.0 | 1.5 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| | | Engineering Sciences Laboratory | 3.0 | 2.4 | 2.6 | 1 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | 2.0 | 1.4 | 1 | 1 | 1.2 | 0.4 | 0.6 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 |
| NSS / YRC / NSO / Club Activities# | 2.0 | 0.0 | 3.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 3.0 | - | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | | |
| Year II | Semester III | Transforms and Partial Differential Equations | 3.0 | 3.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Applied Mechanics | 3.0 | 1.0 | 1.0 | 1.0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 3.0 | 1.2 | 1.0 | 2.0 | |
| | | Fluid Mechanics | 2.4 | 2.0 | 1.6 | 1.0 | 2.4 | 2.0 | 1.0 | 1.0 | 1.0 | 2.4 | 2.2 | 2.4 | 2.8 | 2.2 | 2.4 | |
| | | Surveying and Levelling | 2.4 | 2.5 | 0.0 | 3.0 | 1.2 | 2.0 | 2.0 | 1.5 | 2.4 | 2.4 | 2.0 | 2.3 | 2.4 | 1.8 | 2.5 | 2.6 |
| | | Construction Materials | 1.3 | 1.3 | 1.5 | 1.5 | 1.0 | 2.0 | 2.5 | 1.0 | 2.0 | 1.5 | 3.0 | 2.0 | 2.5 | 1.0 | 2.0 | 1.5 |
| | | Soil Mechanics | 2.6 | 2.6 | 2.2 | 2.0 | 1.0 | 1.7 | 1.5 | 1.0 | 1.0 | 2.0 | 1.0 | 2.5 | 1.3 | 1.5 | 2.0 | 2.3 |
| | | Surveying and Levelling Laboratory | 2.6 | 2.8 | 2.0 | 2.0 | 1.2 | 2.0 | 2.0 | 1.5 | 3.0 | 2.4 | 2.0 | 2.6 | 2.8 | 1.6 | 2.6 | 2.6 |
| | | Construction Materials Laboratory | 3.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 1.0 | 2.0 | 0.8 | 0.4 | 1.6 | 2.0 | 0.0 | 1.0 | 3.0 |
| | | Computer Aided Drafting and Modelling Laboratory | 3.0 | 0.0 | 0.0 | 0.0 | 3.0 | 2.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 1.0 | 2.0 | 0.0 | 1.0 | 3.0 |

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|-----------------|--------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year II | Semester IV | Applied Mathematics for Civil Engineering | 3.0 | 3.0 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Strength of Materials | 2.0 | 3.0 | 2.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 2.6 | 1.6 | 1.0 | 1.4 |
| | | Applied Hydraulic Engineering | 3.0 | 3.0 | 2.0 | 1.6 | 1.0 | 2.0 | 2.0 | 1.0 | 2.0 | 1.0 | 1.0 | 3.0 | 2.2 | 2.4 | 2.8 | 2.2 | |
| | | Construction Techniques and Equipments | 1.6 | 2.8 | 2.5 | 2.6 | 2.4 | 2.0 | 2.0 | 1.0 | 1.4 | 1.4 | 2.4 | 1.4 | 2.8 | 2.6 | 2.6 | 2.0 | |
| | | Irrigation Engineering | 3.0 | 2.0 | 2.5 | 2.0 | 2.3 | 3.0 | 2.0 | 3.0 | 1.0 | 2.5 | 1.3 | 2.0 | 2.5 | 3.0 | 2.5 | 2.3 | |
| | | Foundation Engineering | 2.8 | 2.2 | 2.5 | 1.7 | 0.0 | 2.0 | 2.0 | 1.6 | 2.3 | 1.6 | 0.0 | 3.0 | 2.8 | 2.5 | 2.5 | 1.5 | |
| | | NCC Credit Course Level - I* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Strength of Materials Laboratory | 3.0 | 2.4 | 2.0 | 1.6 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 0.0 | 2.0 | 2.0 | 2.4 | 1.6 | 1.4 | |
| | | Fluid Mechanics and Machinery Laboratory | 3.0 | 2.4 | 2.0 | 1.6 | 1.0 | 2.4 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.4 | 2.2 | 2.4 | 2.8 | 2.2 | |
| | | Soil Mechanics Laboratory | 2.0 | 1.2 | 1.8 | 2.4 | 2.0 | 2.0 | 2.0 | 0.0 | 1.5 | 0.0 | 2.0 | 2.4 | 2.6 | 1.6 | 1.8 | 2.4 | |
| Year III | Semester V | Structural Analysis – I | 3.0 | 3.0 | 3.0 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 3.0 | 2.0 | 1.0 | 1.2 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | | Design of Reinforced Cement Concrete Elements | 2.4 | 1.8 | 2.0 | 2.3 | 1.0 | 2.0 | 3.0 | 2.0 | 1.6 | 2.6 | 1.0 | 2.4 | 1.0 | 1.0 | 2.0 | 0.0 | |
| | | Highway and Railway Engineering | 3.0 | 1.0 | 1.4 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 3.0 | 1.0 | 1.0 | 1.2 | 3.0 | 1.0 | 1.0 | 1.6 | |
| | | Remote Sensing and GIS for Civil Engineering | 1.0 | 2.0 | 2.0 | 2.3 | 1.6 | 2.0 | 3.0 | 0.0 | 0.0 | 2.6 | 0.0 | 2.4 | 2.6 | 1.6 | 1.0 | 1.4 | |
| | | Environmental Studies | 2.8 | 1.8 | 1.0 | 1.0 | 0.0 | 2.2 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | NCC Credit Course Level-II | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Building drawing and detailing Laboratory | 3.0 | 2.0 | 0.0 | 2.0 | 2.0 | 3.0 | 0.0 | 1.6 | 3.0 | 2.0 | 0.0 | 1.8 | 3.0 | 2.0 | 2.0 | 1.3 | |
| | | Highway Engineering Laboratory | 1.5 | 2.0 | 2.6 | 1.5 | 2.0 | 2.5 | 1.0 | 3.0 | 2.0 | 1.8 | 1.0 | 1.3 | 1.0 | 1.3 | 1.0 | 1.5 | |

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|-----------------|----------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | *Survey Camp | 3.0 | 1.8 | 1.5 | 2.0 | 3.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 2.0 | 2.4 | 1.8 | 1.3 | 1.3 |
| Year III | Semester VI | Structural Analysis – II | 3.0 | 3.0 | 3.0 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 3.0 | 2.0 | 1.0 | 1.2 | 3.0 | 3.0 | 3.0 | 3.0 |
| | | Design of Steel structural elements | 2.0 | 2.8 | 2.5 | 2.2 | 2.6 | 2.0 | 1.5 | 2.0 | 1.8 | 2.0 | 0.0 | 2.2 | 3.0 | 2.6 | 1.6 | 2.8 |
| | | Water Supply and Waste Water Engineering | 2.8 | 3.0 | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 1.6 | 2.2 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 2.0 | 2.0 |
| | | Water Supply and Wastewater Analysis Laboratory | 2.0 | 1.8 | 1.8 | 1.8 | 2.0 | 1.8 | 2.0 | 2.4 | 1.8 | 1.6 | 2.0 | 2.6 | 2.0 | 2.0 | 2.0 | 1.6 |
| | | Irrigation Design and Environmental Drawing Laboratory | 3.0 | 2.0 | 3.0 | 2.0 | 0.0 | 1.8 | 1.0 | 1.2 | 1.0 | 1.0 | 0.0 | 1.8 | 3.0 | 1.6 | 2.0 | 1.6 |
| | | Professional Communication Laboratory | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Year IV | Semester VII | Estimation, Costing and Valuation | 2.6 | 2.0 | 2.0 | 1.0 | 1.7 | 2.0 | 2.0 | 1.0 | 2.0 | 3.0 | 2.0 | 2.0 | 3.0 | 1.7 | 3.0 | 1.5 |
| | | Dynamics and Earthquake Resistant Structures | 1.0 | 2.0 | 2.3 | 2.0 | 1.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.7 | 1.0 | 1.0 | 1.5 | 1.0 | 2.0 | 1.5 |
| | | Human Values and Ethics | 0.0 | 0.0 | 1.0 | 2.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Mini Project | 1.0 | 1.5 | 2.0 | 1.0 | 2.0 | 1.0 | 2.0 | 1.0 | 3.0 | 1.0 | 2.0 | 2.3 | 2.0 | 1.5 | 1.5 | 3.0 |
| | | Structural drawing and detailing Laboratory | 2.4 | 1.8 | 2.0 | 2.3 | 1.0 | 2.0 | 3.0 | 2.0 | 1.6 | 2.6 | 1.0 | 2.4 | 1.0 | 1.0 | 2.0 | 0.0 |
| | | **Internship | 1.7 | 2.0 | 2.0 | 2.0 | 2.0 | 1.0 | 1.0 | 2.0 | 2.3 | 1.2 | 2.0 | 2.0 | 2.0 | 2.5 | 2.0 | 3.0 |
| Year IV | Semester VIII | Project Work | 1.0 | 1.5 | 2.0 | 1.0 | 2.0 | 1.0 | 2.0 | 1.0 | 3.0 | 1.5 | 2.0 | 2.5 | 2.0 | 1.5 | 1.5 | 3.0 |

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|-------------------|-------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | MANAGEMENT ELECTIVE | Principles of Management | 1.0 | 2.0 | 1.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Total Quality Management | 1.0 | 2.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Human Resources Management | 0.0 | 1.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Entrepreneurship Development | 1.0 | 2.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | MANDATORY COURSES - I | Introduction to Gender Studies | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Elements of Literature | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Patent Drafting for Beginners | 1.0 | 2.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Industrial Psychology | 2.0 | 3.0 | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Indian Constitution | 2.0 | 3.0 | 1.8 | 1.2 | 2.5 | 1.5 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | MANDATORY COURSES -II | Well Being with Traditional Practices - Yoga, Ayurvedha and Siddha | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | History of Science and Technology in India | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | Awareness of Cyber Security and Cyber Law | 2.0 | 2.5 | 2.0 | 2.0 | 0.0 | 2.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.5 | |
| | | Industrial Safety | 3.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | |
| VERTICAL I | STRUCTURAL ENGINEERING | Repair and Rehabilitation of Structures | 1.5 | 1.5 | 2.7 | 1.3 | 2.0 | 2.3 | 1.5 | 1.7 | 1.0 | 1.5 | 1.5 | 2.0 | 3.0 | 2.3 | 2.0 | 1.8 | |
| | | Prefabricated Structures | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 | |
| | | Theory of Structures | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 | |
| | | Prestressed Concrete Structures | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 | |
| | | Bridge Engineering | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 | |
| | | Industrial Structures | 1.0 | 1.0 | 2.3 | 1.3 | 2.0 | 1.5 | 1.0 | 0.0 | 2.0 | 1.5 | 1.3 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | |

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|--------------|---------------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| VERTICAL II | CONSTRUCTION TECHNIQUES AND PRACTICES | Formwork Engineering | 2.4 | 2.5 | 2.7 | 2.3 | 2.0 | 2.0 | 2.0 | 1.0 | 2.6 | 2.0 | 2.4 | 2.0 | 3.0 | 3.0 | 2.5 | 3.0 |
| | | Construction Equipment And Machinery | 2.4 | 2.4 | 2.6 | 2.2 | 2.4 | 2.6 | 2.4 | 2.2 | 2.8 | 2.0 | 2.2 | 2.2 | 2.4 | 2.2 | 2.8 | 2.2 |
| | | Sustainable Construction And Lean Construction | 2.6 | 1.3 | 2.4 | 1.6 | 1.5 | 1.6 | 2.4 | 1.0 | 1.0 | 1.0 | 2.4 | 1.6 | 3.0 | 2.6 | 3.0 | 2.6 |
| | | Construction, Planning and Scheduling | 2.3 | 3.0 | 2.0 | 3.0 | 3.0 | 2.5 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 2.7 | 3.0 | 2.5 | 3.0 | 2.0 |
| | | Green Building Design | 1.0 | 2.0 | 2.0 | 2.3 | 1.6 | 2.0 | 3.0 | 0.0 | 0.0 | 2.6 | 0.0 | 2.4 | 1.2 | 1.0 | 2.0 | 1.0 |
| | | Advanced Construction Techniques | 1.6 | 2.8 | 2.5 | 2.6 | 2.4 | 2.0 | 2.0 | 1.0 | 1.4 | 1.4 | 2.4 | 1.4 | 2.6 | 2.8 | 2.6 | 2.6 |
| VERTICAL III | GEOTECHNICAL ENGINEERING | Geo Environmental Engineering | 1.8 | 1.6 | 2.3 | 2.0 | 1.7 | 2.2 | 2.6 | 2.0 | 2.7 | 2.0 | 1.0 | 3.0 | 1.6 | 2.0 | 2.4 | 1.4 |
| | | Ground Improvement Techniques | 2.2 | 3 | 2.6 | 2 | 2.2 | 2.4 | 2.2 | 1.4 | 2.2 | 1.6 | 1.2 | 3 | 3 | 3 | 2.8 | 2 |
| | | Soil Dynamics and Machine Foundations | 2.2 | 2.6 | 2.4 | 2.6 | 1.7 | 2.6 | 2 | 2.4 | 1.8 | 1 | 1 | 3 | 2.6 | 2.6 | 2.6 | 1.8 |
| | | Rock Mechanics | 2.6 | 2.6 | 2.8 | 2.2 | 2.4 | 2.6 | 2.2 | 1.8 | 2.4 | 1.4 | 2.6 | 3 | 3 | 2.4 | 2.6 | 2 |
| | | Earth Retaining Structures | 2.6 | 2.2 | 2.8 | 2.4 | 2.8 | 2.4 | 1.6 | 1.8 | 1.8 | 2 | 2.8 | 2.8 | 2.2 | 2.4 | 2.4 | 2.2 |
| | | Design of Sub Structures | 2.4 | 2.0 | 1.8 | 1.8 | 2.4 | 1.8 | 2.2 | 1.7 | 1.8 | 1.8 | 1.8 | 2.0 | 2.3 | 2.4 | 2.2 | 2.0 |
| VERTICAL IV | TRANSPORTATION AND INFRASTRUCTURE | Traffic Engineering and Management | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |
| | | Urban Planning and Development | 2.8 | 2.0 | 2.6 | 1.5 | 2.5 | 1.3 | 1.0 | 1.0 | 2.6 | 2.0 | 1.7 | 2.0 | 2.8 | 2.0 | 1.3 | 1.0 |
| | | Smart Cities | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |
| | | Intelligent Transport Systems | 3.0 | 2.5 | 2.6 | 2.0 | 2.8 | 1.3 | 1.0 | 1.0 | 2.6 | 2.0 | 1.7 | 2.0 | 2.8 | 2.4 | 1.3 | 1.0 |
| | | Pavement Engineering | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |
| | | Transportation Planning Process | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |

| | | | | | | | | | | | | | | | | | | |
|-------------|-----------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| VERTICAL V | ENVIRONMENTAL ENGINEERING | Climate Change Adaptation and Mitigation | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.8 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 1.5 | 1.6 | 1.5 |
| | | Air Pollution and Control Engineering | 1.0 | 1.7 | 2.3 | 3.0 | 0.0 | 1.3 | 2.7 | 2.7 | 1.5 | 1.5 | 2.0 | 2.7 | 2.0 | 2.0 | 1.3 | 1.0 |
| | | Environmental Social Impact Methodology and Assessment | 1.0 | 1.5 | 2.0 | 2.3 | 0.0 | 2.0 | 3.0 | 2.2 | 0.0 | 2.6 | 0.0 | 2.4 | 1.0 | 1.3 | 0.0 | 1.0 |
| | | Solid and Hazardous Waste Management | 1.8 | 2.5 | 2.0 | 2.0 | 1.8 | 0.0 | 2.0 | 0.0 | 2.0 | 2.0 | 0.0 | 0.0 | 2.3 | 1.7 | 1.7 | 1.3 |
| | | Environment and Agriculture | 2.0 | 2.8 | 2.0 | 2.0 | 2.7 | 1.7 | 2.3 | 2.5 | 1.0 | 1.0 | 1.7 | 2.3 | 1.8 | 1.6 | 1.6 | 1.3 |
| | | Environment, Health and Safety | 2.0 | 2.5 | 2.0 | 3.0 | 1.8 | 0.0 | 2.0 | 0.0 | 2.4 | 2.0 | 0.0 | 0.0 | 2.4 | 1.8 | 2.5 | 1.8 |
| VERTICAL VI | WATER RESOURCES ENGINEERING | Participatory Water Resources Management | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.3 | 0.0 | 1.7 | 1.7 | 1.5 | 1.8 | 1.2 | 1.2 | 1.6 |
| | | Ground Water Engineering | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.8 | 1.2 | 1.3 | 1.5 |
| | | Water Resources Systems Engineering | 2.0 | 2.0 | 1.8 | 1.5 | 2.8 | 1.0 | 1.0 | 1.0 | 0.0 | 1.5 | 0.0 | 1.8 | 1.2 | 1.2 | 1.6 | 2.0 |
| | | Integrated Water Resources Management | 1.0 | 1.3 | 1.0 | 0.0 | 1.5 | 1.0 | 1.0 | 1.3 | 2.0 | 1.0 | 1.8 | 1.7 | 1.8 | 1.2 | 1.6 | 1.6 |
| | | Hydrology and Water Resources Engineering | 1.0 | 1.3 | 1.5 | 0.0 | 1.5 | 1.0 | 1.5 | 1.8 | 2.0 | 1.0 | 2.0 | 1.7 | 1.8 | 1.2 | 1.6 | 1.6 |
| | | Water Quality Modelling and Management | 1.0 | 1.0 | 1.3 | 0.0 | 1.5 | 1.0 | 1.5 | 1.5 | 2.0 | 1.0 | 1.5 | 1.7 | 1.8 | 1.2 | 1.6 | 1.6 |

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University, Chennai,
'A' grade accredited by NAAC, NBA accredited ISO 9001: 2015 Certificated)

B.E. CIVIL ENGINEERING REGULATIONS – 2023 CHOICE BASED CREDIT SYSTEM CURRICULA& SYLLABI (I – VIII SEMESTERS)

SEMESTER I

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|------------------|-------------|--|----------|-----------------|----------|-----------|-----------|-----------|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | EN3111 | Professional English - I | HSMC | 3 | 0 | 0 | 3 | 3 |
| 2. | MA3122 | Matrices and Calculus | BSC | 3 | 1 | 0 | 4 | 4 |
| 3. | PH3123 | Engineering Physics | BSC | 3 | 0 | 0 | 3 | 3 |
| 4. | CH3124 | Engineering Chemistry | BSC | 3 | 0 | 0 | 3 | 3 |
| 5. | GE3131 | Basic Electrical and Electronics Engineering | ESC | 3 | 0 | 0 | 3 | 3 |
| 6. | GE3111 | தமிழர் மரபு / Heritage of Tamils | HSMC | 1 | 0 | 0 | 1 | 1 |
| PRACTICAL | | | | | | | | |
| 7. | EN3119 | English Language Learning Laboratory | HSMC | 0 | 0 | 2 | 2 | 1 |
| 8. | GE3121 | Physics and Chemistry Laboratory | BSC | 0 | 0 | 4 | 4 | 2 |
| 9. | GE3134 | Engineering Practices Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| Total | | | | 16 | 1 | 10 | 27 | 22 |

SEMESTER II

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|---------------|-------------|--|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | EN3211 | Professional English - II | HSMC | 3 | 0 | 0 | 3 | 3 |
| 2. | MA3222 | Statistics and Numerical Methods | BSC | 3 | 1 | 0 | 4 | 4 |
| 3. | PH3221 | Physics for Civil Engineering | BSC | 3 | 0 | 0 | 3 | 3 |
| 4. | CH3221 | Chemistry of Construction Materials | BSC | 3 | 0 | 0 | 3 | 3 |
| 5. | GE3231 | Problem solving and Python Programming | ESC | 3 | 0 | 0 | 3 | 3 |
| 6. | GE3211 | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | HSMC | 1 | 0 | 0 | 1 | 1 |

| THEORY CUM PRACTICAL | | | | | | | | |
|-----------------------------|--------|---|-----|-----------|----------|-----------|----------------|----------------|
| 7. | GE3233 | Engineering Graphics and Design | ESC | 1 | 0 | 4 | 5 | 3 |
| PRACTICAL | | | | | | | | |
| 8. | GE3221 | Engineering Sciences Laboratory | BSC | 0 | 0 | 4 | 4 | 2 |
| 9. | GE3232 | Problem Solving and Python Programming Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| 10. | GE3251 | NSS / YRC / NSO / Club Activities # | PCD | 0 | 0 | 0 | 0 [#] | 0 [#] |
| Total | | | | 17 | 1 | 12 | 30 | 24 |

Conducted after college hours

SEMESTER III

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|------------------|-------------|--|----------|-----------------|----------|-----------|-----------|-----------|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | MA3321 | Transforms and Partial Differential Equations | BSC | 3 | 0 | 0 | 3 | 3 |
| 2. | CE3361 | Applied Mechanics | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | CE3362 | Fluid Mechanics | PCC | 3 | 0 | 0 | 3 | 3 |
| 4. | CE3363 | Surveying and Levelling | PCC | 3 | 0 | 0 | 3 | 3 |
| 5. | CE3364 | Construction Materials | PCC | 3 | 0 | 0 | 3 | 3 |
| 6. | CE3365 | Soil Mechanics | PCC | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | | |
| 7. | CE3366 | Surveying and Levelling Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |
| 8. | CE3367 | Construction Materials Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| 9. | CE3368 | Computer Aided Drafting and Modelling Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| Total | | | | 18 | 0 | 10 | 28 | 23 |

SEMESTER IV

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|---------------|-------------|---|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | MA3421 | Applied Mathematics for Civil Engineering | BSC | 2 | 0 | 0 | 2 | 2 |
| 2. | CE3461 | Strength of Materials | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | CE3462 | Applied Hydraulic Engineering | PCC | 3 | 0 | 0 | 3 | 3 |
| 4. | CE3463 | Construction Techniques and Equipments | PCC | 3 | 0 | 0 | 3 | 3 |
| 5. | CE3464 | Irrigation Engineering | PCC | 3 | 0 | 0 | 3 | 3 |
| 6. | CE3465 | Foundation Engineering | PCC | 3 | 0 | 0 | 3 | 3 |

| | | | | | | | | |
|------------------|--------|--|-----|-----------|----------|----------|-----------|-------------|
| 7. | GE3451 | NCC Credit Course Level - I* | PCD | 3* | 0 | 0 | 3* | 3* |
| PRACTICAL | | | | | | | | |
| 8. | CE3466 | Strength of Materials Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| 9. | CE3467 | Fluid Mechanics and Machinery Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| 10. | CE3468 | Soil Mechanics Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| Total | | | | 17 | 0 | 9 | 26 | 21.5 |

*NCC Credit course level 1 and 2 is offered for NCC students only. The grades earned by the students will be recorded in the mark sheet. However the same shall not be considered for the computation of CGPA.

SEMESTER V

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|------------------|-------------|---|----------|-----------------|----------|----------|-----------|-----------|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | CE3561 | Structural Analysis – I | PCC | 3 | 0 | 0 | 3 | 3 |
| 2. | CE3562 | Design of Reinforced Cement Concrete Elements | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | CE3563 | Highway and Railway Engineering | PCC | 3 | 0 | 0 | 3 | 3 |
| 4. | CE3564 | Remote Sensing and GIS for Civil Engineering | PCC | 3 | 0 | 0 | 3 | 3 |
| 5. | CE3531 | Environmental Studies | ESC | 2 | 0 | 0 | 2 | 2 |
| 6. | PCEXXX | Professional Elective-I | PEC | 3 | 0 | 0 | 3 | 3 |
| 7. | PCEXXX | Professional Elective-II | PEC | 3 | 0 | 0 | 3 | 3 |
| 8. | GE3551 | NCC Credit Course Level-II* | PCD | 3* | 0 | 0 | 3* | 3* |
| PRACTICAL | | | | | | | | |
| 9. | CE3565 | Building drawing and detailing Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| 10. | CE3566 | Highway Engineering Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| 11. | CE3541 | #Survey Camp | EEC | 0 | 0 | 0 | 0 | 1 |
| Total | | | | 20 | 0 | 6 | 26 | 24 |

* NCC Credit Course level II is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

#Survey Camp to be conducted for a period of 2 weeks during 4th Semester Summer Vacation

SEMESTER VI

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|---------------|-------------|-------------------------------------|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | CE3661 | Structural Analysis – II | PCC | 3 | 0 | 0 | 3 | 3 |
| 2. | CE3662 | Design of Steel structural elements | PCC | 3 | 0 | 0 | 3 | 3 |

| | | | | | | | | |
|------------------|--------|--|------|-----------|----------|----------|-----------|-------------|
| 3. | CE3663 | Water Supply and Waste Water Engineering | PCC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCEXXX | Professional Elective-III | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCEXXX | Professional Elective-IV | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | MAN1XX | Management Elective | HSMC | 2 | 0 | 0 | 2 | 2 |
| 7. | MXXXXX | Mandatory Course-I | MC | 3 | 0 | 0 | 3 | 0 |
| PRACTICAL | | | | | | | | |
| 8. | CE3664 | Water Supply and Wastewater Analysis Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |
| 9. | CE3665 | Irrigation Design and Environmental Drawing Laboratory | PCC | 0 | 0 | 3 | 3 | 1.5 |
| 10. | EN3649 | Professional Communication Laboratory | EEC | 0 | 0 | 2 | 2 | 1 |
| Total | | | | 20 | 0 | 9 | 29 | 21.5 |

& Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

Management Elective shall be chosen from the Management Elective Courses.

SEMESTER VII

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|------------------|-------------|--|----------|-----------------|----------|----------|-----------|-----------|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | CE3761 | Estimation, Costing and Valuation | PCC | 3 | 0 | 0 | 3 | 3 |
| 2. | CE3762 | Dynamics and Earthquake Resistant Structures | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCEXXX | Professional Elective-V | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCEXXX | Professional Elective-VI | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | BA3711 | Human Values and Ethics | HSMC | 2 | 0 | 0 | 2 | 2 |
| 6. | OXXXXX | Open Elective | OEC | 3 | 0 | 0 | 3 | 3 |
| 7. | MXXXXX | Mandatory Course-II | MC | 3 | 0 | 0 | 3 | 0 |
| PRACTICAL | | | | | | | | |
| 8. | CE3741 | Mini Project | EEC | 0 | 0 | 4 | 4 | 2 |
| 9. | CE3763 | Structural drawing and detailing Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |
| 10. | CE3742 | Internship | EEC | 0 | 0 | 0 | 0 | 1 |
| Total | | | | 20 | 0 | 8 | 28 | 22 |

* Open Elective shall be chosen from the emerging technologies.

& Mandatory Course-II is a Non-credit Course (Student Shall select one course from the list given under MC-II).

SEMESTER VIII

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|------------------|-------------|--------------|----------|-----------------|----------|-----------|-----------|-----------|
| | | | | L | T | P | Total | |
| PRACTICAL | | | | | | | | |
| 1. | CE3841 | Project Work | EEC | 0 | 0 | 20 | 20 | 10 |
| Total | | | | 0 | 0 | 20 | 20 | 10 |

TOTAL NO OF CREDITS: 168

MANAGEMENT ELECTIVES

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|---------------|-------------|------------------------------|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | MAN101 | Principles of Management | HSMC | 2 | 0 | 0 | 2 | 2 |
| 2. | MAN102 | Total Quality Management | HSMC | 2 | 0 | 0 | 2 | 2 |
| 3. | MAN103 | Human Resources Management | HSMC | 2 | 0 | 0 | 2 | 2 |
| 4. | MAN104 | Entrepreneurship Development | HSMC | 2 | 0 | 0 | 2 | 2 |

MANDATORY COURSES – I

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|---------------|-------------|--------------------------------|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | MBA101 | Introduction to Gender Studies | MC | 3 | 0 | 0 | 3 | 0 |
| 2. | MEN101 | Elements of Literature | MC | 3 | 0 | 0 | 3 | 0 |
| 3. | MBA102 | Patent drafting for beginners | MC | 3 | 0 | 0 | 3 | 0 |
| 4. | MBA103 | Industrial Psychology | MC | 3 | 0 | 0 | 3 | 0 |
| 5. | MBA104 | Indian constitution | MC | 3 | 0 | 0 | 3 | 0 |

MANDATORY COURSES – II

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|---------------|-------------|--|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| THEORY | | | | | | | | |
| 1. | MGE201 | Well Being with Traditional Practices - Yoga, Ayurvedha and Siddha | MC | 3 | 0 | 0 | 3 | 0 |
| 2. | MGE202 | History of Science and Technology in India | MC | 3 | 0 | 0 | 3 | 0 |
| 3. | MCY201 | Awareness of Cyber Security and Cyber Law | MC | 3 | 0 | 0 | 3 | 0 |
| 4. | MME201 | Industrial Safety | MC | 3 | 0 | 0 | 3 | 0 |

PROFESSIONAL ELECTIVE COURSES : VERTICALS

| VERTICAL I (Structural Engineering) | VERTICAL II (Construction Techniques and Practices) | VERTICAL III (Geotechnical Engineering) | VERTICAL IV (Transportation and Infrastructure) | VERTICAL V (Environmental Engineering) | VERTICAL VI (Water Resources Engineering) |
|--|--|--|--|--|--|
| Repair and Rehabilitation of Structures | Formwork Engineering | Geo Environmental Engineering | Traffic Engineering and Management | Climate Change Adaptation and Mitigation | Participatory Water Resources Management |
| Prefabricated Structures | Construction Equipment And Machinery | Ground Improvement Techniques | Urban Planning and Development | Air Pollution and Control Engineering | Groundwater Engineering |
| Advanced Concrete Technology | Sustainable Construction And Lean Construction | Soil Dynamics and Machine Foundations | Smart Cities | Environmental Social Impact Methodology and Assessment | Water Resources Systems Engineering |
| Theory of Structures | Construction Planning and Management | Rock Mechanics | Intelligent Transport Systems | Solid and Hazardous Waste Management | Integrated Water Resources Management |
| Bridge Engineering | Green Building Design | Earth Retaining Structures | Pavement Engineering | Environment and Agriculture | Hydrology and Water Resources Engineering |
| Industrial Structures | Advanced Construction Techniques | Design of Sub Structures | Transportation Planning Process | Environment, Health and Safety | Water Quality Modelling and Management |

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V, VI and VII. These courses are listed in groups called verticals that represent a particular area of specialisation. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI or VII. The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2023. Clause 19 Total number of courses per vertical may change in each programme of study as 6 or 7 or 8. If there is shortage of courses in a vertical the same may be chosen from another vertical of the same programme.

PROFESSIONAL ELECTIVE COURSES

VERTICAL I: STRUCTURAL ENGINEERING

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|-------|-------------|---|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | PCE101 | Repair and Rehabilitation of Structures | PEC | 3 | 0 | 0 | 3 | 3 |
| 2. | PCE102 | Prefabricated Structures | PEC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCE103 | Theory of Structures | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCE104 | Prestressed Concrete Structures | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCE105 | Bridge Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | PCE106 | Industrial Structures | PEC | 3 | 0 | 0 | 3 | 3 |

VERTICAL II: CONSTRUCTION TECHNIQUES AND PRACTICES

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|-------|-------------|--|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | PCE201 | Formwork Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 2. | PCE202 | Construction Equipment And Machinery | PEC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCE203 | Sustainable Construction And Lean Construction | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCE204 | Construction, Planning and Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCE205 | Green Building Design | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | PCE206 | Advanced Construction Techniques | PEC | 3 | 0 | 0 | 3 | 3 |

VERTICAL III: GEOTECHNICAL ENGINEERING

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|-------|-------------|---------------------------------------|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | PCE301 | Geo Environmental Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 2. | PCE302 | Ground Improvement Techniques | PEC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCE303 | Soil Dynamics and Machine Foundations | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCE304 | Rock Mechanics | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCE305 | Earth Retaining Structures | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | PCE306 | Design of Sub Structures | PEC | 3 | 0 | 0 | 3 | 3 |

VERTICAL IV: TRANSPORTATION AND INFRASTRUCTURE

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|-------|-------------|------------------------------------|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | PCE401 | Traffic Engineering and Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 2. | PCE402 | Urban Planning and Development | PEC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCE403 | Smart Cities | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCE404 | Intelligent Transport Systems | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCE405 | Pavement Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | PCE406 | Transportation Planning Process | PEC | 3 | 0 | 0 | 3 | 3 |

VERTICAL V: ENVIRONMENTAL ENGINEERING

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|-------|-------------|--|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | PCE501 | Climate Change Adaptation and Mitigation | PEC | 3 | 0 | 0 | 3 | 3 |
| 2. | PCE502 | Air Pollution and Control Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCE503 | Environmental Social Impact Methodology and Assessment | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCE504 | Solid and Hazardous Waste Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCE505 | Environment and Agriculture | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | PCE506 | Environment, Health and Safety | PEC | 3 | 0 | 0 | 3 | 3 |

VERTICALVI: WATER RESOURCES ENGINEERING

| S.No. | Course Code | Course Title | Category | Contact Periods | | | | C |
|-------|-------------|---|----------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | PCE601 | Participatory Water Resources Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 2. | PCE602 | Groundwater Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 3. | PCE603 | Water Resources Systems Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 4. | PCE604 | Integrated Water Resources Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | PCE605 | Hydrology and Water Resources Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 6. | PCE606 | Water Quality Modelling and Management | PEC | 3 | 0 | 0 | 3 | 3 |

OPEN ELECTIVE

| S.No. | Course Code | Course Title | COURSE OFFERING DEPARTMENT | Contact Periods | | | | C |
|-------|-------------|--|----------------------------|-----------------|---|---|-------|---|
| | | | | L | T | P | Total | |
| 1. | OCS101 | IoT and its Applications | CSE& CYS | 3 | 0 | 0 | 3 | 3 |
| 2. | OCS102 | Machine Learning with R | CSE& CYS | 3 | 0 | 0 | 3 | 3 |
| 3. | OCS103 | Tamil Computing | CSE& CYS | 3 | 0 | 0 | 3 | 3 |
| 4. | OCY101 | Cyber Forensic and Investigation | CSE& CYS | 3 | 0 | 0 | 3 | 3 |
| 5. | OCY102 | Social Media Security | CSE& CYS | 3 | 0 | 0 | 3 | 3 |
| 6. | OEC101 | Introduction to 5G Communication Networks | ECE&MDE | 3 | 0 | 0 | 3 | 3 |
| 7. | OEC102 | Introduction to Industrial IoT | ECE&MDE | 3 | 0 | 0 | 3 | 3 |
| 8. | OEC103 | Arduino Programming and it's applications | ECE&MDE | 3 | 0 | 0 | 3 | 3 |
| 9. | OMD101 | Introduction to Food Processing | ECE&MDE | 3 | 0 | 0 | 3 | 3 |
| 10. | OMD102 | Introduction to Biomedical Instrumentation | ECE&MDE | 3 | 0 | 0 | 3 | 3 |
| 11. | OEE101 | Renewable Energy Sources | EEE &EIE | 3 | 0 | 0 | 3 | 3 |
| 12. | OEE102 | Energy Conservation and Management | EEE &EIE | 3 | 0 | 0 | 3 | 3 |
| 13. | OEE103 | Electric and Hybrid Vehicles | EEE &EIE | 3 | 0 | 0 | 3 | 3 |
| 14. | OEI101 | Fundamentals of Robotics | EEE &EIE | 3 | 0 | 0 | 3 | 3 |
| 15. | OEI102 | Sensors for Engineering Applications | EEE &EIE | 3 | 0 | 0 | 3 | 3 |
| 16. | OIT101 | Multimedia Technologies | IT&AI-DS | 3 | 0 | 0 | 3 | 3 |
| 17. | OIT102 | 3D Printing and Its Applications | IT&AI-DS | 3 | 0 | 0 | 3 | 3 |
| 18. | OIT103 | Web Frameworks | IT&AI-DS | 3 | 0 | 0 | 3 | 3 |
| 19. | OAD101 | Foundation of Data Science | IT&AI-DS | 3 | 0 | 0 | 3 | 3 |
| 20. | OAD102 | Open Source Software Tools | IT&AI-DS | 3 | 0 | 0 | 3 | 3 |
| 21. | OME101 | Refrigeration and Air-conditioning | MECH | 3 | 0 | 0 | 3 | 3 |
| 22. | OME102 | Advanced Manufacturing Processes | MECH | 3 | 0 | 0 | 3 | 3 |
| 23. | OME103 | Material Testing and Characterization | MECH | 3 | 0 | 0 | 3 | 3 |
| 24. | OME104 | Hazardous Waste Management | MECH | 3 | 0 | 0 | 3 | 3 |
| 25. | OME105 | Automotive Engineering | MECH | 3 | 0 | 0 | 3 | 3 |
| 26. | OPH101 | Advanced Functional Materials | PHY | 3 | 0 | 0 | 3 | 3 |
| 27. | OCH101 | Nanomaterials and Applications | CHE | 3 | 0 | 0 | 3 | 3 |

SUMMARY

| S.No | Subject Area | Credits as per Semester | | | | | | | | Credits Total |
|------|------------------------|-------------------------|-----------|-----------|-------------|-----------|-------------|-----------|-----------|---------------|
| | | I | II | III | IV | V | VI | VII | VIII | |
| 1 | HSMC | 5 | 4 | | | | 2 | | | 11 |
| 2 | BSC | 12 | 10 | 3 | 2 | | | | | 27 |
| 3 | ESC | 5 | 10 | | | 2 | | | | 17 |
| 4 | PCD | | 1# | | | | | | | 1# |
| 5 | PCC | | | 20 | 19.5 | 15 | 12.5 | 8 | | 75 |
| 6 | PEC | | | | | 6 | 6 | 6 | | 18 |
| 7 | OEC | | | | | | | 3 | | 3 |
| 8 | EEC | | | | | 1 | 1 | 5 | 10 | 17 |
| 9 | Non-Credit/(Mandatory) | | | | 3# | 3# | 3& | 3& | | 12# |
| | Total | 22 | 24 | 23 | 21.5 | 24 | 21.5 | 22 | 10 | 168 |

TOTAL NO OF CREDITS: 168

COURSES IN MINOR DEGREE
OFFERED BY DEPARTMENT OF MANAGEMENT STUDIES
DEPARTMENT OF AGRICULTURAL ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
FOR B.E / B.TECH (HONOURS) / OPTIONAL COURSES (R2023)

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

Enrolment for B.E. / B. Tech. (Honours) / Minor degree (Optional) A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E./B.Tech. (Honours) Minor degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also. Complete details are available in clause 19 of Regulations 2023.

VERTICALS FOR MINOR DEGREE (In addition to all the verticals of other programmes)

| VERTICAL I | VERTICAL II | VERTICAL III | VERTICAL IV | VERTICAL V |
|--|---|-------------------------------------|--|--|
| Fintech and Block Chain | Entrepreneurship | Public Administration | Business Data Analytics | Environment and Sustainability |
| Financial Management | Foundations of Entrepreneurship | Principles of Public Administration | Statistics for Management | Sustainable infrastructure Development |
| Fundamentals of Investment | Team Building and Leadership Management | Constitution of India | Data mining for Business Intelligence | Sustainable Agriculture and Environmental Management |
| Banking, Financial Services and Insurance | Creativity and Innovation in Entrepreneurship | Public Personnel Administration | Human Resource Analytics | Sustainable Bio Materials |
| Introduction to Block chain and its Applications | Principles of Marketing Management for Business | Administrative Theories | Marketing and Social Media Web Analytics | Materials for Energy Sustainability |
| Fintech Personal Finance and Payments | Human Resource Management for Entrepreneurs | Indian Administrative System | Operation and Supply Chain Analytics | Green Technology |
| Introduction to Fintech | Financing New Business Ventures | Public Policy Administration | Financial Analytics | Environmental Quality Monitoring and Analysis |

| VERTICAL I: FINTECH AND BLOCKCHAIN | | | | | | | | |
|------------------------------------|-------------|---|----------|-----------------|---|---|-------|---|
| S. No. | Course Code | Course Title | Category | Contact Periods | | | | C |
| | | | | L | T | P | Total | |
| 1 | BAM101 | Financial Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | BAM102 | Fundamentals of Investment | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | BAM103 | Banking, Financial Services and Insurance | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | CSM101 | Introduction to Blockchain and its Applications | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | BAM104 | Fintech Personal Finance and Payments | PEC | 3 | 0 | 0 | 3 | 3 |
| 6 | BAM105 | Introduction to Fintech | PEC | 3 | 0 | 0 | 3 | 3 |

| VERTICAL II: ENTREPRENEURSHIP | | | | | | | | |
|-------------------------------|-------------|--|----------|-----------------|---|---|-------|---|
| S. No. | Course Code | Course Title | Category | Contact Periods | | | | C |
| | | | | L | T | P | Total | |
| 1 | BAM201 | Foundations of Entrepreneurship | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | BAM202 | Team Building and Leadership Management for Business | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | BAM203 | Creativity and Innovation in Entrepreneurship | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | BAM204 | Principles of Marketing Management for Business | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | BAM205 | Human Resource Management for Entrepreneurs | PEC | 3 | 0 | 0 | 3 | 3 |
| 6 | BAM206 | Financing New Business Ventures | PEC | 3 | 0 | 0 | 3 | 3 |

| VERTICAL III: PUBLIC ADMINISTRATION | | | | | | | | |
|-------------------------------------|-------------|-------------------------------------|----------|-----------------|---|---|-------|---|
| S. No. | Course Code | Course Title | Category | Contact Periods | | | | C |
| | | | | L | T | P | Total | |
| 1 | BAM301 | Principles of Public Administration | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | BAM302 | Constitution of India | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | BAM303 | Public Personnel Administration | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | BAM304 | Administrative Theories | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | BAM305 | Indian Administrative System | PEC | 3 | 0 | 0 | 3 | 3 |
| 6 | BAM306 | Public Policy Administration | PEC | 3 | 0 | 0 | 3 | 3 |

| VERTICAL IV: BUSINESS DATA ANALYTICS | | | | | | | | |
|--------------------------------------|-------------|--|----------|-----------------|---|---|-------|---|
| S. No. | Course Code | Course Title | Category | Contact Periods | | | | C |
| | | | | L | T | P | Total | |
| 1 | BAM401 | Statistics For Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | BAM402 | Data Mining For Business Intelligence | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | BAM403 | Human Resource Analytics | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | BAM404 | Marketing And Social Media Web Analytics | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | BAM405 | Operation And Supply Chain Analytics | PEC | 3 | 0 | 0 | 3 | 3 |
| 6 | BAM406 | Financial Analytics | PEC | 3 | 0 | 0 | 3 | 3 |

| VERTICAL V: ENVIRONMENT AND SUSTAINABILITY | | | | | | | | |
|--|-------------|--|----------|-----------------|---|---|-------|---|
| S. No. | Course Code | Course Title | Category | Contact Periods | | | | C |
| | | | | L | T | P | Total | |
| 1 | AGM501 | Sustainable infrastructure Development | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | AGM502 | Sustainable Agriculture and Environmental Management | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | AGM503 | Sustainable Bio Materials | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | AGM504 | Materials for Energy Sustainability | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | AGM505 | Green Technology | PEC | 3 | 0 | 0 | 3 | 3 |
| 6 | AGM506 | Environmental Quality Monitoring and Analysis | PEC | 3 | 0 | 0 | 3 | 3 |

OBJECTIVES:

- To upgrade the English language skills of students by introducing communication techniques, speaking and grammar learning activities which are relevant to authentic contexts.
- To improve the basic reading and writing skills of the learners.
- To enhance the communicative competence of the first-year engineering students.
- To enable learners to use language effectively in academic/work contexts.
- To help learners understand content- context in relevant situations.

UNIT – I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Listening: Podcast watching – Listening for new words and pronunciation.

Speaking: Note of appreciation for classmates /family member – formal appreciation of someone, expression of feelings.

Reading: Books, shorts stories to be read. Filling forms (i.e.) post office or bank.

Writing: Film and series Review / Book Review, Email and Informal letters.

Language and Vocabulary development: WH questions, Yes/No questions, Single Word Substitutes, Pronouns, Parts of Speech, Question tags, Prefixes and Suffixes.

UNIT – II NARRATION AND SUMMATION

Listening: Books – Short Stories to be read aloud in class for listening purpose.

Speaking: Short stories to be read and narrated in the class.

Reading: Reading favourite blogs on Travel, Sports and Food and expressing opinions regarding the same.

Writing: Paragraph writing, Report – field trip / I.V., Autobiography and Comprehension.

Language and Vocabulary development: Tenses — Past, Antonyms, Synonyms, Subject Verb agreement and Prepositions.

UNIT – III DESCRIPTION OF A PROCESS/PRODUCT

Listening: Listening to snippets from celebrities/ National leaders' lives.

Speaking: Narrating personal experiences/ events — Expression of emotions and feelings.

Reading: Reading short biographies – famous people and description of the same.

Writing: Instruction, Product / Process description and Advertisements (Normal and Block).

Language and Vocabulary development: Adjectives- Degrees of Comparison, Tenses — Present, Compound Nouns, Homonyms, Homophones and Discourse markers — connective and sequence words.

UNIT – IV CLASSIFICATION AND INTERPRETATION

Listening: Listening to Ted Talks.

Speaking: Recreating a Ted talk session in the class.

Reading: Newspaper Reading (Editorial) and understanding.

Writing: Note making, Blogging, Interpretation of charts and graphs.

Language and Vocabulary development: Articles, Collocations and Phrasal Verbs.

UNIT – V EXPRESSION OF THOUGHTS AND IDEAS

Listening: Listening to audio books and answering questions.

Speaking: Presentation on a non-technical topic.

Reading: Editorials from newspaper.

Writing: Essay writing – Descriptive and Narrative essays.

Language and Vocabulary development: Tenses – future, Negative statements and questions, Punctuations, Cause and Effect, Content and Function words.

COURSE OUTCOMES

At the end of the course, learners will be able

1. To strengthen the basics of grammar.
2. To narrate informal and informal situations.
3. To describe a process/product and express opinion.
4. To interpret and analyse the content/information given.
5. To write short essays, personal letters and emails in English.

TEXT BOOKS:

1. English for Science and Technology Cambridge University Press,2021. Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr. Deep Mary Francis, Dr.K.N.Shoba and Dr.Lourdes Joevani, Department of English, Anna University.
2. Technical Communication — Principles and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford Univ.Press, 2016, New Delhi.

REFERENCES:

1. Effective Communication Skill, Kulbhusan Kumar, R.S.Salaria, Khanna Publishing House.
2. Wings of Fire - An Autobiography by A.P.J Abdul Kalam with Arun Tiwari, Sangam Books Ltd , Edition: 50, 1999.
3. World's Most Popular Short Stories Saki Maupassant, Anton Chekhov, O Henry Paperback.
4. Professional Speaking skills, Aruna Koneru, Oxford University Press.
5. English For Engineers and Technologists, Orient Blackswan Private Ltd. Department of English, Anna University, 2020.

| EN3111 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|----------|------------|----------|----------|------------|------------|------------|----------|----------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 3 | - | - | - | - | - | - |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 1 | 1 | - | - | - | 1 |
| CO3 | 2 | - | 2 | 2 | - | - | - | - | - | 3 | - | 1 | - | - | 1 | - |
| CO4 | 3 | 3 | - | 2 | - | - | 2 | - | - | 3 | - | - | - | - | 1 | 1 |
| CO5 | 1 | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| Average | 2.2 | 2.6 | 2.0 | 2.0 | 2.0 | - | 2.0 | - | - | 2.8 | 1.0 | 1.0 | - | - | 1.0 | 1.0 |

OBJECTIVES:

- To understand and apply matrix techniques for engineering applications.
- To familiarize the student with basic calculus and traditions of traditional calculus.
- To solve the problems in single and multivariable calculus and plays an important role in science, economics, engineering.
- Vector calculus can be widely used for modeling the various laws of physics.
- To familiarize the student with multiple integrals and their usage in find the area and volume of two and three dimensional objects.

UNIT- I : MATRICES**9L+3T**

Eigen values and Eigen vectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigen vectors - Statement and Applications of Cayley-Hamilton Theorem - Reduction of a quadratic form into canonical form by orthogonal transformation.

UNIT- II : DIFFERENTIAL CALCULUS OF ONE VARIABLE**9L+3T**

Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Rolle's Theorem and Mean Value theorem - Taylor's series- Maxima and Minima of functions of one variable.

UNIT- III : DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES**9L+3T**

Partial derivatives - Total derivatives - Jacobians and properties - Taylor's series for functions of two variables - Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT- IV : MULTIPLE INTEGRALS**9L+3T**

Double integrals in Cartesian and polar coordinates - Change of order of integration - Area enclosed by plane curves - Change of variables in Polar coordinates - Triple integrals - Volume of solids.

UNIT- V : VECTOR CALCULUS

9L+3T

Gradient and directional derivative — Divergence and curl — Vector identities — Irrotational and Solenoidal vector fields – Vector Integration Green’s, Gauss divergence and Stoke’s theorems — Verification and application in evaluating line, surface and volume integrals.

TOTAL: 45L + 15T PERIODS

OUTCOMES:

- To apply the idea of reducing complex problems into simple form using matrix technique.
- Basic application of single variable calculus in engineering problems.
- This course equips the students to have basic knowledge and understanding of multivariable calculus.
- Basic application of Double and Triple integrals used in Engineering real life problems
- To study Vector Calculus and apply the application of vectors in modeling the various laws of physics

TEXT BOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.
3. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", S.Chand Private Ltd., 11th Edition, 2005.
2. Veerarajan.T, "Engineering Mathematics", McGraw Hill Education(India) Private Ltd 2019.

REFERENCE BOOKS:

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt. Ltd., 2011.
2. James Stewart, "Calculus : Early Transcendentals ", Cengage Learning, 8th Edition, New Delhi, 2015
3. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, Pearson Publishing, 2017.

4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.

| MA3122 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|---|---|---|---|---|----|----|------------|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | | - | - | - | 1 | - | - | - | - |
| CO3 | 3 | 2 | 2 | 1 | - | - | - | | - | - | - | 1 | - | - | - | - |
| CO4 | 3 | 2 | 2 | 1 | - | - | - | | - | - | - | 1 | - | - | - | - |
| CO5 | 3 | 2 | 2 | 1 | - | - | - | | - | - | - | 1 | - | - | - | - |
| Average | 3.0 | 2.0 | 2.0 | 1.0 | - | - | - | - | - | - | - | 1.0 | - | - | - | - |

OBJECTIVES:

- To enhance the fundamental knowledge in crystalline materials and its applications.
- To explore the knowledge in the production of ultrasonic waves and its application.
- To familiarize the basics of laser and its technical advances in scientific, industrial and health care areas.
- To understand the principle of optical fibre and its applications.
- To explore basic concepts of quantum and dual nature of particle.

UNIT- I: PROPERTIES OF MATERIALS**9**

Elasticity - Hooke's law - Stress-strain diagram and its uses - Poisson ratio - factors affecting elastic modulus and tensile strength.

Single crystalline, polycrystalline and amorphous materials - unit cell - space lattice - crystal systems - Bravais lattice - Miller indices - d-spacing - characteristics of unit cell - SC, BCC, FCC and HCP structure - - thermal and mechanical properties of materials - crystal growth techniques - Czochralski and Bridgmann.

UNIT- II: ULTRASONICS**9**

Introduction - properties - Production: Magnetostriction and Piezoelectric method - Acoustic grating - determination of ultrasonic velocity in liquid - Application: Detection of flaw in materials (Non Destructive Testing) - ultrasonic soldering, welding - SONAR - diagnostic sonography - cars' air bag sensor - dispersion of fog - Probe sonication for 2D material formation.

UNIT- III: LASER AND ITS APPLICATIONS

9

Basic concepts and characteristics - Einstein's A and B coefficients (derivation) - population inversion - Pumping methods - Nd-YAG laser - CO₂ laser - Semiconductor lasers: homo junction and heterojunction - applications: laser welding, laser cutting, laser cooling, pattern formation by laser etching, laser bar code scanner - LIDAR - Laser tissue interaction, laser surgery - Holography - NLO - electro-optic effect.

UNIT-IV: FIBRE OPTICS

9

Structure and principle - propagation of light through optical fibre - acceptance angle, numerical aperture - fractional index change - Types of optical fibres (material, mode and refractive index) - Attenuation: absorption, scattering and bending - dispersion - fibre optic communication system (Block diagram) and advantages over conventional methods - fibre optic sensors: pressure and displacement - Endoscope.

UNIT-V: QUANTUM PHYSICS

9

Black body radiation and energy distribution spectrum - Planck's theory of radiation - matter waves - de-Broglie wavelength in terms of energy, voltage and temperature - Electron diffraction - G.P.Thomson experiment - wave function and its physical significance - Schrödinger's wave equation - time independent and time dependent equations - Particle in a one-dimensional box- Normalization of wave function - Quantum Tunnelling - Scanning Tunnelling Microscope.

TOTAL: 45 PERIODS

OUTCOMES:

After completion of this course, the students should be able to

1. To understand the properties of materials, crystalline material and growth techniques.
2. To understand the basics, generation and application of ultrasonics.
3. To acquire knowledge on the concepts of lasers and their applications in industry and medical field.

4. To conversant on principle behind the fibres and their applications in communication and devices made out of optical fibre.
5. To get knowledge on advanced physics concepts of quantum theory and its applications.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.
4. Brijlal and Subramanyam, "Properties of Matter", S .Chand publishing, 2002.
5. M.N.Avadhanulu & P.G.Kshirasagar, "A Text Book of Engineering Physics" – IX Edition, S.Chand Publications, 2014.
6. V.Rajendiran, Engineering Physics, Tata McGraw-Hill, New Delhi. 2011.

REFERENCES :

- 1.Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
- 2.Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
- 3.Shatendra Sharma & Jyotsna Sharma, "Engineering Physics". Pearson, 2018.

| PH3123 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO's | | | |
|----------------|------------------|------------|------------|------------|-------------|------------|------------|---|---|----|----|------------|-------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | 1 | - | - | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO5 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| Average | 2.8 | 1.4 | 1.4 | 1.4 | 1.25 | 1.0 | 1.0 | - | - | - | - | 1.0 | - | - | - | - |

OBJECTIVES

- To make the students familiar with boiler feed water requirements, related problems and domestic water treatment techniques.
- To introduce the basic concepts and applications of chemical thermodynamics.
- To acquaint the student with the principles of chemical kinetics and its applications towards engineering.
- To make the student conversant with the basics of surface chemistry and catalysis.
- To inculcate the students with the basics principles and preparatory methods of nanomaterials.

UNIT-I : WATER TECHNOLOGY**9**

Introduction-sources of water-impurities present in water-hard water and hardness — types, Municipal water treatment: primary treatment and disinfection - Desalination of brackish water: Reverse Osmosis, Boiler troubles: scale and sludge, caustic embrittlement, boiler corrosion priming and foaming, Treatment of boiler feed water — Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning). External treatment: Ion exchange process, cooling waters (Langelier index).

UNIT – II : CHEMICAL THERMODYNAMICS**9**

Introduction-terminology of thermodynamics, the first law of thermodynamics: enthalpy, second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions: Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions, Criteria of spontaneity; Gibbs-Helmholtz equation, Clausius-Clapeyron equation, Maxwell relations, Van't Hoff isotherm and isochore.

UNIT – III: CHEMICAL KINETICS

9

Introduction-factors influencing the rate of reaction, order and molecularity of a reaction, kinetic equations of different orders (first, second and third order) - determination of the order of a reaction, the temperature dependence of reaction rates, unimolecular reactions, photochemical reactions and chain reactions, Theories of reaction rates, lasers in chemistry, fast reactions.

UNIT - IV : SURFACE CHEMISTRY AND CATALYSIS

9

Adsorption: classification - adsorption of gases on solids - adsorption from solutions - adsorption isotherms - applications of adsorption - Freundlich's adsorption isotherm - Langmuir's adsorption isotherm, B.E.T isotherm. Catalysis: introduction - types of catalysis - criteria - autocatalysis - catalytic poisoning and catalytic promoters - acid - base catalysis - enzyme catalysis - Michaelis - Menten equation.

UNIT – V : NANOCHEMISTRY

9

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties; Types of nanomaterials: Definition, properties and uses of - nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electrospinning. Applications of nanomaterials in medicine, agriculture, food science and energy resources.

Total Periods: 45

OUTCOMES

At the end of the course, the student should be able:

1. To infer the quality of water from quality parameter data and propose suitable treatment.
2. To apply the knowledge of chemical thermodynamics for material design and aspects
3. To recommend the proper chemical kinetics for engineering processes and applications.

- To recognize the surface morphology and its engineering applications.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

TEXT BOOKS

- Payal B. Joshi and Shashank Deep, “Engineering Chemistry”, Oxford University Press, New Delhi, 2019.
- Shikha Agarwal, “Engineering Chemistry”-Fundamentals and Applications, 2nd Edition, Cambridge University Press, New Delhi, 2019.
- P. C. Jain and Monika Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2021.

REFERENCES

- R. V. Gadag and A. Nithyananda Shetty, “Engineering Chemistry”, 3rd Edition, Wiley & I.K. International (P), LTD, New Delhi, 2019.
- S.S. Dara and S.S. Umare, “A Text Book of Engineering Chemistry”, 12th Edition, S. Chand & Company LTD, New Delhi, 2018.
- B. Sivasankar, “Engineering Chemistry”, Tata McGraw-Hill Publishing Company LTD, 2023.
- B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.

| CH3124 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO's | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|---|---|----|----|-----|-------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 3 | 2 | - | 1 | 3 | - | - | - | - | 2 | - | - | - | - |
| CO2 | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | 1 | | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 3 | 2 | 1 | - | 1 | - | - | - | - | 2 | | - | - | - |
| Average | 2.8 | 1.8 | 2.2 | 1.2 | 1.0 | 1.0 | 2.0 | - | - | - | - | 2.0 | - | - | - | - |

COURSE OBJECTIVES

- To introduce the basics of electric circuits and analysis.
- To impart knowledge in the basics of working principles and application of electrical machines.
- To introduce analog devices and their characteristics.
- To educate on the fundamental concepts of digital electronics.
- To introduce the functional elements and working of measuring instruments.

UNIT- I : ELECTRICAL CIRCUITS**9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor — Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources — Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor — Steady state analysis of RLC circuits (Simple problems only).

UNIT-II : ELECTRICAL MACHINES**9**

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT- III : ANALOG ELECTRONICS**9**

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium — PN Junction Diodes, Zener Diode –Characteristics Applications — Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT — Types, I-V Characteristics and Applications, Rectifier and Inverters.

UNIT-IV : DIGITAL ELECTRONICS

9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations — minimization using K maps (Simple Problems only).

UNIT-V : MEASUREMENTS AND INSTRUMENTATION

9

Functional elements of an instrument, Standards and calibration, Operating Principle, types Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able:

1. Ability to compute the electric circuit parameters for simple problems
2. Ability to explain the working principle and applications of electrical machines
3. Ability to analyze the characteristics of analog electronic devices
4. Ability to explain the basic concepts of digital electronics
5. Ability to explain the operating principles of measuring instruments

TEXTBOOKS

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020.
2. S.K. Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.
3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008.
4. James A. Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2015.

REFERENCE BOOKS

1. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
3. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
4. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

| GE3131 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|---|---|----|----|------------|------------|------------|------------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | 2 | - | - | 3 | - | - | - | - | - | 2 | - | 2 | - |
| CO2 | 3 | 2 | - | - | - | 2 | - | 2 | - | - | - | - | 1 | 2 | - | 2 |
| CO3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | 1 | - | 3 | - | 2 | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | 1 | - | - | - | - | - | 2 | 1 | - | 2 |
| Average | 2.8 | 1.8 | 1.7 | 3.0 | 2.0 | 2.0 | 2.0 | - | - | - | - | 1.8 | 1.5 | 2.5 | 2.0 | - |

அலகு I மொழி மற்றும் இலக்கியம்

3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள்- தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள்- சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம்- திருக்குறளில் மேலாண்மைக் கருத்துகள்- தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணப் பெளத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்- சிற்றிலக்கியங்கள்- தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் – சிற்பக் கலை

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை –ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள் , பொம்மைகள்- தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள்

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

3

நாட்டுப்புற கதைகள், பாடல்கள்-தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து- ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம்- வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள்- தமிழர்கள்

போற்றிய அறக்கோட்பாடு -தமிழ் சங்கம்-சங்கம் வளர்த்த தமிழ்-சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும்- சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு இந்தியா மற்றும் வெளிநாட்டின் பிற பகுதிகளின் தமிழ்ப் பண்பாட்டின் தாக்கம்-சுயமாரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு- கல்வெட்டுகள், கையெழுத்துப்படிக்கல்கள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு

Total Periods: 15 Hours

TEXT CUM REFERENCES:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர். இல.சுந்தரம். (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

COURSE OBJECTIVE:

The course aims to

- Enhance the employability and career skills of students.
- Orient the students towards grooming as a professional.
- Make them industry ready.
- Develop their confidence and help them attend interviews successfully.
- Help students to interact confidently in a professional scenario.

UNIT 1: PRONUNCIATION 6

Tone- Pronunciation — Intonation- Reading Aloud and Addressing- Syllable- Rhythm- Accent- Wrongly Pronounced words -Poetry Reading

UNIT 2: NON VERBAL COMMUNICATION 6

Non Verbal Communication - Facial expressions- Eye contact - Subtle (and not so subtle) gestures -Tone of voice — Touch- Posture -Personal space.

UNIT 3: SELF INTRODUCTION AND PRESENTATION 6

Self Introduction- Introducing oneself to the audience- Introducing the Topic — answering questions – Individual Presentation Practice – Presenting Visuals effectively - 5 Minute Presentations.

UNIT 4: BASICS OF SOFT SKILLS 6

Recognizing differences between groups and teams — managing time — networking professionally — Respecting social protocols- understanding career management — Developing a long - term career plan- making career changes.

UNIT 5: GROUP DISCUSSION 6

Introduction to Group Discussion – Participating in Group discussions – Understanding group dynamics – Brainstorming the Topic – Questioning and Clarifying – GD Strategies – activities to improve GD Skills.

TOTAL: 30 PERIODS

COURSE OUTCOME:

At the end of the course, the learners will be able to:

1. Pronounce the words correctly.
2. Understand the nonverbal clues.
3. Make an effective presentation.
4. Adequate soft skills required for the workplace.
5. Participate confidently in Group Discussions.

REFERENCES:

1. Professional Communication by Meenakshi Raman & Sangeeta Sharma, Oxford Univ.Press, 2014.
2. Soft Skills by S. Hariharan , N. Soundarajaran and S.P. Shanmugapriya MJP Publishers, Edition: 2013
3. Soft Skills for Everyone by Butterfield , Jeff, Cengage Learning India Pvt. Ltd.,2015. New Delhi..

| EN3119 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO's | | | |
|---------|------------------|-----|---|-----|---|---|---|---|---|-----|----|----|-------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | - | - | - | 1 | - | - | - | - | - | 3 | - | 1 | - | - | - | - |
| CO2 | 1 | 1 | - | - | - | - | 1 | - | - | 2 | - | 1 | - | - | - | - |
| CO3 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | 3 | - | 1 | - | - | - | - |
| CO4 | 2 | 1 | 1 | - | - | - | 3 | - | - | 3 | - | 1 | - | - | - | - |
| CO5 | - | 1 | - | 1 | - | - | - | - | - | 3 | - | 1 | - | - | - | - |
| Average | 1.6 | 1.2 | 1 | 1.3 | 2 | - | 2 | - | - | 2.8 | - | 1 | - | - | - | - |

GE3121

PHYSICS AND CHEMISTRY LABORATORY

L T P C

(Common to all Branches of B.E./B.Tech. Programmes)

0 0 4 2

PHYSICS LABORATORY (Any five experiments to be conducted)

OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Calculation of lattice cell parameter – X-ray diffraction method.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
3. (a). Compact disc- Determination of width of the groove using Laser.
(b). Determination of particle size using Laser
4. (a) Determination of wavelength using Laser
(b) Determination of acceptance angle and numerical aperture in an optical fiber.
5. Determination of Planck's constant using LED.
6. Determination of thickness of a thin wire – Air wedge method
7. Determination of wavelength of mercury spectrum – spectrometer grating
8. Determination of rigidity modulus – Torsion pendulum
9. Determination of Young's modulus by non-uniform bending method.

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course, the students should be able

1. Understand the functioning of various physics laboratory equipment.

2. Use graphical models to analyze laboratory data.
3. Use mathematical models as a medium for quantitative reasoning and describing physical reality.
4. Access, process and analyze scientific information.
5. Solve problems individually and collaboratively.

REFERENCE

1. Wilson J.D. and Hernaandez Hall C.A.,— Physics Laboratory Experiments, Houghton Mifflin Company, New York, 2005.
2. S. Srinivasan, A Text Book of Practical Physics, S. Sultan Chand publications. 2005
3. R. Sasikumar, Practical Physics, PHI Learning Pvt. Ltd, New Delhi, 2011.

| GE3121 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Average | 3.0 | 2.4 | 2.6 | 1.0 | 1.0 | - | - | - | - | - | - | - | - | - | - | - |

CHEMISTRY LABORATORY: (Any five experiments to be conducted)

OBJECTIVES

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, chloride, and chlorine.
- To familiarise the students with electroanalytical techniques like conductometry and flame photometry to determine the impurities in aqueous solution.
- To find the various characteristics of domestic water.
- To understand the Pseudo first-order kinetics reaction.
- To make the students know the synthesis of nanoparticles.

LIST OF EXPERIMENTS: (Any five experiments to be conducted)

1. Determination of chloride content of water sample by Argentometric method.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard.
5. Determination of types and amount of alkalinity in water samples.
6. Estimation of available chlorine in bleaching powder solution.
7. Conductometric titration of barium chloride against sodium sulfate (Precipitation titration).
8. Estimation of sodium /potassium present in water using a flame photometer.
9. Estimation of TDS of a water sample by gravimetry.
10. Preparation of nanoparticles ($\text{Ag}/\text{Au}/\text{TiO}_2/\text{ZnO}/\text{CuO}$).
11. Pseudo first-order kinetics- ester hydrolysis.

TOTAL: 30 PERIODS

OUTCOMES

At the end of the course, the student should be able:

1. To infer the quality of water samples for alkalinity, hardness, DO, TDS, chloride, and chlorine.
2. To apply the knowledge on the estimation of metal ions, acidity and its precipitation nature towards their process.
3. To recognize the threshold limit for various characteristics of domestic water.
4. To identify the simple method of synthesis of nanoparticles.
5. To understand the pseudo first-order kinetics reaction from ester hydrolysis.

TEXTBOOKS

1. Vogel's Textbook of Quantitative Chemical Analysis (8th Edition, 2014).
2. Suchi Tiwari, Engineering Chemistry Lab Manual, Scitech Publications (India) Pvt. Ltd. (2nd Edition, 2013).
3. Pushpendra Kumar, Laboratory Manual for Engineering Chemistry, Reyansh Authortopic Pvt. Ltd., (1st Edition, 2022).

| GE3121 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|---|-----|---|-----|---|---|----|----|-----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 3 | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 1 | - | - | - | - |
| CO5 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Average | 3 | 2.4 | 2.6 | 1 | 1.2 | - | 0.2 | - | - | - | - | 0.2 | - | - | - | - |

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
- To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment / tools
- To gain the skills for making fitting joints and assembling air conditioner
- To develop the skills for making simple electrical wiring connections using suitable tools
- To provide hands on experience for soldering and gain knowledge about the behavior of electronics components.

GROUP A (CIVIL & MECHANICAL)**I CIVIL ENGINEERING PRACTICE****15****Buildings:**

a) Study of plumbing and carpentry components of residential and industrial buildings safety aspects.

Plumbing Works:

a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

b) Study of pipe connections requirements for pumps and turbines.

c) Preparation of plumbing line sketches for water supply and sewage works.

d) Hands-on-exercise:

Basic pipe connections — Mixed pipe material connection — Pipe connections with different joining components.

e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry works:

a) Study of the joints in roofs, doors, windows and furniture.

b) Hands-on-exercise:

Wood work, joints by sawing, planning and cutting.

II MECHANICAL ENGINEERING PRACTICE

15

Welding:

a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

b) Gas welding practice - Study

Basic Machining:

a) Facing

b) Simple Turning

c) Step Turning

Sheet Metal Work:

a) Forming & Bending

b) Model making – Trays

Demonstration on:

a) Smithy operations, upsetting, swaging, setting down and bending.

b) Foundry operations like mould preparation for gear and step cone pulley.

c) Assembly of centrifugal pump

d) Assembly of air conditioner

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

15

1. Residential house wiring using Switches, Fuse, Indicator, Lamp and Energy meter.

2. Fluorescent Lamp Wiring.

3. Staircase Wiring.
4. Measurement of Voltage, Current, Power and Power factor in electrical circuit.
5. Measurement of Energy using Analog & Digital Energy meter.
6. Measurement of Earth Resistance.
7. Study of Industrial house wiring.
8. Identification & Study of protective devices: Fuses & Fuse carriers, MCB, ELCB and Isolators with ratings and usage.

IV ELECTRONICS ENGINEERING PRACTICE

15

1. Study of Electronic components and equipments — Resistor, colour coding measurement of AC signal parameter (peak-peak, RMS period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice — Components, Devices and Circuits — Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

1. Carry out various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
2. Fabricate carpentry components and pipe connections including plumbing works and use welding equipment's to join the structures.
3. Carry out the basic machining operations, make the models using sheet Metal works. Illustrate on centrifugal pump, air conditioner, operations of smithy, foundry and fittings.
4. Carry out basic home electrical works and measure the electrical quantities

5. Elaborate on the electronics components, gates and soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

- | | |
|---|---------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets |
| 2. Carpentry vice (fitted to work bench) | 15 Nos. |
| 3. Standard woodworking tools | 15 Sets |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |

MECHANICAL

- | | |
|---|----------|
| 1. Arc welding transformer with cables and holders | 5 Nos. |
| 2. Welding booth with exhaust facility | 5 Nos. |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. | 2 Nos. |
| 5. Centre lathe | 2 Nos. |
| 6. Hearth furnace, anvil and smithy tools | 2 Sets |
| 7. Moulding table, foundry tools | 2 Sets |
| 8. Power Tool: Angle Grinder | 2 Nos. |
| 9. Study-purpose items: centrifugal pump, air-conditioner | One each |
| 10. Fitting tools, Hack saw frame, 12' file, hack saw blade | 15 Nos. |

ELECTRICAL

- | | |
|--|---------|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Fluorescent Lamp | 15 Sets |
| 3. Electrical measuring instruments | 10 Sets |
| 4. Analog & Digital energy meter | 5 Sets |
| 5. Megger | 2 |

ELECTRONICS

2. Soldering guns 10 Nos.
3. Assorted electronic components for making circuits 50 Nos.
4. Small PCBs 10 Nos.
5. Multimeters 10 Nos.
6. Study purpose items: Telephone, FM radio, low-voltage power supply.

| GE3134 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|---|---|-----|----|-----|-----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - |
| CO2 | - | 1 | 2 | - | 3 | - | - | - | - | - | 1 | | - | - | - | - |
| CO3 | - | - | - | 3 | 2 | - | - | - | - | - | - | 1 | - | - | - | - |
| CO4 | - | 2 | 3 | 1 | 2 | - | - | - | - | - | - | | - | - | - | - |
| CO5 | - | 3 | 2 | 2 | - | - | - | - | 1 | - | - | | - | - | - | - |
| Average | 3.0 | 2.0 | 2.3 | 2.0 | 2.3 | 1.0 | - | - | 1.0 | - | 1.0 | 1.0 | - | - | - | - |

OBJECTIVES

The course prepares the second semester Engineering students

- To develop strategies and techniques to enhance their reading skills.
- To engage them in meaningful activities in order to improve their listening, speaking, reading and writing skills.
- To improve their ability to write effective job application, resumes and draft impressive reports.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To participate in group discussions.

UNIT – I: MAKING COMPARISON**9**

Listening: Clippings of Ted talk, cartoon and interviews of sports personalities for listening and discussion.

Speaking: Descriptions and discussions based on newspaper.

Reading: Learning shades of meaning (using Thesaurus) and inferring the context from general passages.

Writing: Compare & Contrast essays and Jumbled Sentences.

Language and Vocabulary development: Prepositional phrases, contextual meaning of words. Verbal Analogy, Same word used as Noun and Verb.

UNIT – II: EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING**9**

Listening: Anecdotes to be read from books like Chicken Soup books. Evaluative listening — Advertisement and Product description.

Speaking: Marketing a product, persuasive speech

Reading: Description of any product / jewellery, Brochures and Manual.

Writing: Formal letters- letters of complaint, appreciation, and suggestion, Comprehension and E-mail (formal)

Language and Vocabulary development: Active & Passive, Infinitive, Gerund, Purpose Statements, Adverbs and Word formation

UNIT – III: ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 9

Listening: Listen to English songs and find the lyrics/new words

Speaking: Role play and Interviews

Reading: Reading magazine articles, Excerpts from literary texts

Writing: Job Application, Resume, Cover letter, SWOC Analysis and Recommendations.

Language and Vocabulary development: Correction of errors, If conditional, Sentence completion and Connotations.

UNIT – IV: ANALYZING PROBLEMS AND EXPRESSING SOLUTIONS 9

Listening: Watching Stand-up comedies and comprehending ideas expressed there.

Speaking: Speak about the Stand-up comedies viewed and express personal views about the same

Reading: Reading different types of books (novels, short stories, biographies, magazines etc. and speaking about the same.

Writing: Dialogue Writing, Checklist and Problem Solving essays.

Language and Vocabulary development: Reported Speech, Modals, Slogan writing and Conjunctions.

UNIT – V: REPORTING EVENTS 9

Listening: Listening to spot errors, listening to varied dialects and accents of English.

Speaking: Group discussion- Expression of opinions, assertion, coercion etc.

Reading: Reading life experiences of common man from magazines.

Writing: Accident Report / Survey Report and Letters to the Editor.

Language and Vocabulary development: Numerical Adjective, Idioms, Vocabulary – Shades of Meaning.

TOTAL: 45 PERIODS

COURSE OUTCOME

At the end of the course, learners will be able to

1. To compare and contrast ideas and information from technical texts.
2. To incorporate basic grammar structures to express appreciation, suggestion and complaint in writing.
3. To draft effective resumes using appropriate vocabulary and to avoid common errors.
4. To analyse problems so as to arrive at appropriate solutions and to communicate relevantly.
5. To draft technical reports, letters and to express ideas creatively.

TEXT BOOKS:

1. English for Science and Technology Cambridge University Press,2021. Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr. Deep Mary Francis, Dr.K.N.Shoba and Dr.Lourdes Joevani, Department of English, Anna University.
2. Technical Communication — Principles and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford Univ.Press, 2016, New Delhi.
3. Technical English for Professional — Advanced by C. Gangalakshmi, B. Rathika and L. Saranraj, Cengage Learning India Pvt. Ltd.,2022.

REFERENCES:

1. Learning to communicate — Dr. V. Chellammal, Oxford Univ.Press,2001 New Delhi.
2. Business Correspondence and Report Writing by Prof. R. C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

3. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
4. Improve Your Writing ed. V.N Arora Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
5. English For Engineers and Technologists, Orient Blackswan Private Ltd. Department of English, Anna University, 2020.

| EN3211 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO's | | | |
|----------------|------------------|------------|------------|------------|------------|---|------------|---|---|------------|------------|------------|-------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | - | 1 | 2 | 1 | - | - | - | - | - | 3 | - | 1 | - | - | - | - |
| CO2 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | 3 | 1 | 1 | - | - | - | - |
| CO3 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - |
| CO4 | 2 | 3 | 2 | 3 | - | - | 2 | - | - | 3 | - | - | - | - | - | - |
| CO5 | 2 | - | 1 | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| Average | 2.0 | 2.0 | 1.4 | 2.0 | 2.0 | - | 2.0 | - | - | 2.8 | 1.0 | 1.0 | - | - | - | - |

OBJECTIVES:

- This course aims at providing the necessary basic concepts of statistical and Numerical Methods for solving numerically different problems of engineering and Technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and differentiation and integration in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT- I: STATISTICAL HYPOTHESIS TESTS**9L+3T**

Sampling distributions - Tests for single mean and difference of means (Large and small samples) — Tests for single variance and equality of variances — Chi square test for goodness of fit — Independence of attributes.

UNIT- II : EXPERIMENTAL DESIGN FOR ANOVA**9L+3T**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT-III: SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS**9L+3T**

Solution of algebraic and transcendental equations - Fixed point iteration method — Newton - Raphson method - Solution of linear system of equations - Gauss elimination method — Pivoting - Gauss Jordan method — Iterative method of Gauss Seidel — Dominant Eigenvalue of a matrix by Power method.

UNIT-IV: INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **9L+3T**

Lagrange's and Newton's divided difference interpolations — Newton's forward and backward difference interpolation — Approximation of derivatives using interpolation polynomials – Numerical integrations using Trapezoidal, Simpson's rules.

UNIT-V: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9L+3T**

Single step methods: Taylor's series method - Euler's method - Modified Euler's method
Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's and Adams -Bash forth predictor corrector methods for solving first order equations.

TOTAL: 45L+15T PERIOD

OUTCOMES:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the ordinary differential equations with initial and boundary conditions by using certain techniques with engineering application.

TEXT BOOKS:

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi,2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition,2015.

REFERENCE BOOKS:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning,

2016.

2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald.C.F., Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, NewDelhi, 2006.

| MA3222 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO's | | | |
|---------|------------------|-----|---|---|---|---|---|---|---|----|----|----|-------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| Average | 3.0 | 3.0 | - | - | - | - | - | - | - | - | - | - | 1.0 | - | - | - |

OBJECTIVES:

- To understand the concepts of heat transfer through different materials and to study the thermal performance of buildings.
- To impart knowledge on the ventilation and acoustics of buildings.
- To explore the concepts of lighting designs.
- To gain knowledge on the processing and applications of new engineering materials.
- To create an awareness of natural disasters and safety measures.

UNIT- I: THERMAL PERFORMANCE OF BUILDINGS**9**

Principles of heat transfer - fenestrations - thermal conductivity - conduction through compound media: series and parallel - spherical, cylindrical shell method - conductivity of rubber tube - thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings - thermal comfort-indices of thermal comfort - shading devices.

UNIT- II: VENTILATION AND ARCHITECTURAL ACOUSTICS**9**

Principles of natural ventilation - ventilation measurements - Window type air conditioner - Protection against fire to be caused by A.C. systems - classification of sound - decibel - Weber-Fechner law - Sabine's formula (reverberation time) - derivation using growth and decay method - absorption coefficient and its determination - factors affecting acoustics of buildings and their remedies - methods of sound absorptions - absorbing materials - noise and its measurements - impact of noise in multi-storeyed buildings.

UNIT- III: LIGHTING DESIGNS**9**

Radiation quantities - spectral quantities - relationship between luminescence and radiant quantities - photometry: cosines law, inverse square law. Vision - photopic, mesopic, scotopic visions - Visual field glare - day light calculations - day light design of windows - use of models and artificial skies - principles of artificial lighting - types of light fixtures - supplementary artificial lighting.

UNIT- IV: NEW ENGINEERING MATERIALS

9

Composites: Fibre-reinforced plastics (FRP) and fiber-reinforced metals (FRM) - Metallic glasses - melt spinning method - properties and applications - Shape memory alloys - characteristics and applications - Ceramics - manufacturing methods - Slip casting - Isostatic pressing - properties and applications - Nanomaterials - Top-down and bottom-up approaches - structural applications.

UNIT- V: NATURAL DISASTERS

9

Seismology and Seismic waves - Earthquake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able

1. To understand heat transfer through different materials, thermal performance of buildings and thermal insulation.
2. To gain knowledge on the ventilation of buildings and understand the acoustics of buildings.
3. To know the concepts of lighting designs.
4. To gain knowledge on the new engineering materials and their applications in civil engineering.
5. To get an awareness on natural disasters such as earth quake, cyclone, fire, flood and safety measures.

TEXT BOOKS:

1. D.S.Mathur. Elements of Properties of Matter. S Chand & Company, 2010.
2. V.Rajendran, Engineering Physics, Tata McGraw Hill, 2011.
3. Disaster management, S.C.Sharma, Khanna Publishing, 2019.
4. The text book of Building construction S.P. Arora, S.P.Bindra, Dhanpat Rai Publications, 2010.

REFERENCES:

1. K.G.Budinski and M.K.Budinski. Engineering Materials: Properties and Selection. Pearson Education, 2016.
2. V.Rajendran, A.Marikani, Applied Physics, Tata McGraw Hill, 2003.
3. Vibrations, Waves, and Acoustics, 8th Edition by D. Chattopadhyay and P. C. Rakshit, Books & Allied Ltd; 2010.

Online Resources:

1. Marko Pinteric, Building Physics, Springer 2017.
2. Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017.
3. Peter A. Claisse, Civil Engineering Materials, Elsevier, 2016.
4. Patrick L. Abbott, Natural Disasters, McGraw-Hill, 2017.
5. <https://nptel.ac.in/courses/113105081>
6. <https://archive.nptel.ac.in/courses/105/104/105104183/>

| PH3221 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|-------------|------------|------------|------------|----------|------------|---|---|----|----|----------|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 2 | - | 2 | 2 | 2 | - | - | - | - | 1 | - | - | - | - |
| CO2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | 1 | - | - | - | - |
| CO3 | 3 | 1 | 2 | 1 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO4 | 3 | - | 1 | 1 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | - | - | - | - |
| Average | 2.8 | 1.75 | 1.8 | 1.5 | 1.8 | 2 | 1.6 | - | - | - | - | 1 | - | - | - | - |

OBJECTIVES

- To understand the basic knowledge of electrochemistry, corrosion and its control methods.
- To become skilled at using the basic ideas and applications of phase rule and alloys.
- To provoke the students to familiarize with the basic engineering materials and their applications.
- To be aware of the fundamentals of building materials and their applications.
- To know the limit and uses of techniques for analyzing materials.

UNIT - I : ELECTROCHEMISTRY AND CORROSION**9**

Electrode - electrode reaction - redox reaction - origin of electrode potential, oxidation potential - reduction potential - measurement and applications, electrochemical series and its significance - electrochemical cell - Nernst equation (derivation). Corrosion - causes - factors - types - chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electroplating of Au-electroless plating of Ni - paints - constituents and function.

UNIT – II : PHASE RULE AND ALLOYS**9**

Phase rule: introduction, the definition of terms with examples, one component system (water system) - reduced phase rule - construction of phase diagram by thermal analysis - simple eutectic systems, two-component systems (Zn-Mg system). Alloys: introduction - definition- properties of alloys - significance of alloying, functions and effect of alloying elements- ferrous alloys - Nichrome and stainless steel - types (18/8) - heat treatment of steel, non-ferrous alloys - brass and bronze.

UNIT - III : ENGINEERING MATERIALS

9

Abrasives - natural abrasives, artificial abrasives. Refractories - properties - manufacture, common refractory bricks, insulating refractories, cermets, inorganic cermeting materials. Engineering plastics-thermoplastic - thermosetting plastics, Composite materials: Reinforced or filled plastics, polymer blends and alloys.

UNIT- IV : BUILDING MATERIALS

9

Lime - classification - manufacture and properties of lime - cement - classification - portland cement - chemical composition - manufacture of portland cement by wet method - setting and hardening - analysis of cement - concretes - hot and cold weathering of concrete cement and its prevention methods - special cement - plaster of paris. Glass - manufacture, types, properties and uses - recent trends in construction materials.

UNIT - V : ANALYTICAL TECHNIQUES

9

Introduction, absorption of radiation, types of spectra, UV-Visible and IR Spectrophotometer: Instrumentation and applications. Thermal methods of analysis TGA, DTA, DSC. Scanning electron microscopy and Mercury intrusion porosimetry (working principle and applications).

Total: 45 Periods

OUTCOMES

At the end of the course, the student should be able:

1. To build up confidence in the importance of electrochemistry and corrosion.
2. To infer a solid foundational knowledge in phase rule systems and alloys.
3. To recognise engineering materials and uses.
4. To recommend selecting building materials for engineering works and applications.
5. To identify suitable technology in analytical aspects.

TEXTBOOKS

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 18th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2021.
2. S.S. Dara and S.S. Umare, "A Text Book of Engineering Chemistry", 12th Edition, S. Chand & Company LTD, New Delhi, 2018.
3. Shashi Chawla, "A Text Book of Engineering Chemistry", Dhanpat Rai & Co (P) Limited, New Delhi, 2017.

REFERENCES

1. O.G. Palanna, "Engineering Chemistry", 2nd Edition, McGraw Hill Education (India) Private Limited, 2017.
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", 2nd Edition, Cambridge University Press, New Delhi, 2019.
3. P. Purushothama Raj, "Building Construction Materials and Techniques", Pearson Education India, 2016.
4. Haimai Zhang, "Building Materials in Civil Engineering" Woodhead Publishing; United Kingdom, 2016.

| CH3221 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|---|-----|-----|---|---|----|----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 3 | 2 | - | 1 | 1 | - | - | - | - | 2 | - | 2 | 1 | - |
| CO4 | 3 | - | 2 | 3 | - | 1 | 1 | - | - | - | - | 3 | - | 2 | 1 | 1 |
| CO5 | 2 | 1 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | 0.8 | 0.4 | 0.2 |
| Average | 2.0 | 2.0 | 2.0 | 3.0 | | 1.0 | 1.0 | - | - | - | - | 2.5 | - | 1.6 | 0.8 | 0.6 |

OBJECTIVES:

- To know the basics of Python programming
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures and its implementation – lists, tuples, dictionaries.
- To understand Object Oriented Concept in Python.

UNIT – I : PYTHON BASICS**9**

Introduction to Python — Literals — Variables and Identifiers — Data Types — Input Operation – Comments – Reserved words – Indentation – Operators and Expressions

— Modes of python. Conditionals: Boolean values and operators - conditional if - alternative if - chained conditional - Iteration, Illustrative programs: Basic Arithmetic Operations, GCD of numbers, Square root (Newton's Method).

UNIT- II : FUNCTIONS, LIST, TUPLES**9**

Functions, function definition and use. **Fruitful functions:** return values, parameters, local and global scope, recursion. **Lists:** list operations, list slices, list methods, list loop, mutability, list parameters; **Tuples:** tuple assignment, tuple as return value. Comparison of Lists and tuples. Illustrative programs: exchange the values of two variables, square root, Linear and Binary search. Fibonacci series using functions.

UNIT – III : STRINGS, DICTIONARY, SET**9**

Strings: string slices, immutability, string functions and methods, string module. **Dictionaries:** Operations (create, access, add, remove) and methods. (Insert, delete). Set operation (Access, Add, Remove). Illustrative programs: creates a dictionary of radius of a circle and its circumference.

UNIT- IV : FILES, EXCEPTIONS, MODULES AND PACKAGES

9

Files and exception: Text Files, Reading and Writing files, Format operator; Errors and Exceptions, Handling Exceptions, Multiple Except blocks, Modules, Packages; Illustrative programs: word count, copy file, Creating user defined Exceptions.

UNIT- V : CLASSES AND OBJECTS

9

Classes and Objects: Introduction, Classes and Objects, Defining Classes, Creating Objects, Data Abstraction and Hiding, The Class Method and Self Argument, The `__init__()` method, Class Variables and Object Variables, Public and Private data members, Private Methods. Illustrative Programs: Creating Student Class and Objects.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, learners will be able to:

- Develop simple computational problems using control flow statements.
- Decompose a Python program into functions, Modules and Packages.
- Represent compound data using Python lists, tuples, Strings, Set and dictionaries.
- Read and write data from/to files and Exception handling in Python Programs.
- Understand the concepts of Object Oriented Programming.
- To develop real time applications.

TEXT BOOKS:

1. Reema Thareja, “**Python Programming using Problem solving Approach**”, Oxford Higher Education,2018.
2. Allen B. Downey, “**Think Python: How to Think Like a Computer Scientist**”, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
3. Guido van Rossum and Fred L. Drake Jr, “**An Introduction to Python**” — Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, “**Introduction to Computer Science using Python: A Computational Problem-Solving Focus**”, Wiley India Edition, 2013.
2. John V Guttag, “**Introduction to Computation and Programming Using Python**”, Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, “**Fundamentals of Python: First Programs**”, CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, “**Practical Programming: An Introduction to Computer Science using Python 3**”, Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, “**Introduction to Programming in Python: An Inter-disciplinary Approach**”, Pearson India Education Services Pvt. Ltd., 2016.

WEB REFERENCES:

1. <http://greenteapress.com/wp/think-python/>
2. www.docs.python.org
3. <https://nptel.ac.in/courses/106/106/106106182/>

| GE3231 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|----------|------------|------------|---|---|---|---|----|------------|----------|----------|---|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 2 | - | - | 1 |
| CO2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | - | - | 3 | - |
| CO3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | - | - | 1 | - |
| CO4 | 2 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | - | 3 | - | 2 | - |
| CO5 | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - | 1 |
| CO6 | 2 | 2 | - | - | 2 | - | - | - | - | - | 1 | - | 1 | - | - | - |
| Average | 2.3 | 2.5 | 3 | 2.7 | 1.8 | - | - | - | - | - | 1.5 | 2 | 2 | - | 2 | 1 |

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் : 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு. சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ – சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில்நுட்பம் : 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாகச் செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் : 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குழுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும்

முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ் : 3

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT – CUM – REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி / வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by : International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of river Vaigal' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)

(Published by : The Author)

11. Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) – Reference Book.

UNIT- I : WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during sangam Age — Ceramic technology — Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Priod – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – Industries Stone beads — Glass beads — Terracotta beads — Shell beads / bone beats — Archeological evidences – Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Perio, Animal Husbandry — Wells designed for cattle use — Agriculture and Agro Processing — Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING**3**

Development of Scientific Tamil — Tamil computing — Digitalization of Tamil Books — Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL : 15 PERIODS**TEXT – CUM – REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி / வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL — (in print)
6. Social Life of the Tamils — The Classical Period (Dr.S.Singaravelu) (Published by : International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by : International Institute of Tamil Studies.)
9. Keeladi – ‘Sangam City Civilization on the banks of river Vaigal’ (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by : The Author)
11. Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) — Reference Book.

OBJECTIVES:

The main learning objective of this course is to impart knowledge

1. To draw the conics curves and special curves.
2. To draw the orthographic projection of lines and plane surfaces.
3. To draw the projections and solids and Isometric projection of simple solids.
4. To draw the projections and solids and Isometric projection of simple solids.
5. To draw free hand sketching of basic geometrical constructions, multiple views of objects and Perspective Projection of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT- I: PLANE CURVES AND SPECIAL CURVES**11**

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid (Rolling Circle rolls on flat surface only). construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT- II: PROJECTION OF POINTS, LINES AND PLANE SURFACES**12**

Orthographic projection- Principles-Principal planes - First angle projection-projection of points at the First Quadrant only. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) which inclined to both the principal planes by rotating object method.

UNIT- III: PROJECTION OF SOLIDS AND ISOMETRIC PROJECTION 12

Projection of simple solids like prisms, pyramids, cylinders and cones when the axis is inclined to one of the principal planes by the rotating object method. Principles of isometric projection — isometric scale — Isometric projections of simple solids - Prisms, pyramids, cylinders, cones - isometric view of the object from the 2D coded plan.

UNIT- IV: PROJECTION OF SECTIONED SOLIDS & DEVELOPMENT OF SURFACES 12

Sectioning of the above solids in the simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other — obtaining the true shape of the section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

UNIT- V: FREE-HAND SKETCHING AND PERSPECTIVE PROJECTIONS 12

Free Hand sketching: Visualization principles — Representation of Three-Dimensional objects — Layout of views- Free hand sketching of multiple views from pictorial views of objects. Perspective projection of simple solids-Prisms and pyramids by visual ray method.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able:

1. To construct the conics curves and special curves.
2. To construct the orthographic projection of lines and plane surfaces.
3. To construct the projections and solids and Isometric projection of simple solids.
4. To construct projections of section of solids and development of surfaces.
5. To construct free hand sketching of basic geometrical constructions, multiple views of objects and Perspective Projection of simple solids.

TEXTBOOKS:

1. N.D.Bhatt, “Engineering Drawing (Plane and Solid Geometry)”, Charotar Publishing House PVT. LTD. 53rd Edition 2019 (Fifth Reprint).

2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 15th Edition 2018.

REFERENCES :

1. T. Jeyapoovan, “Engineering Graphics Using Auto CAD”, Vikas Publishing House Pvt. LTD, seventh Edition, 2015.
2. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production”, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2011.
4. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2011.
5. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scales to fit solutions within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

| GE3233 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|---|-----|---|-----|---|---|---|-----|-----|----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 3 | - | 1 | - | - | - | 1 | 3 | - | 2 | 2 | 1 | 1 | 1 |
| CO2 | 2 | - | 3 | - | 1 | - | - | - | 1 | 3 | - | 2 | 2 | 1 | 1 | 1 |
| CO3 | 2 | - | 3 | - | 1 | - | - | - | 1 | 3 | - | 2 | 2 | 1 | 1 | 1 |
| CO4 | 2 | - | 3 | - | 1 | - | - | - | 1 | 3 | - | 2 | 2 | 1 | 1 | 1 |
| CO5 | 2 | - | 3 | - | 1 | - | - | - | 1 | 3 | - | 2 | 2 | 1 | 1 | 1 |
| Average | 2.0 | - | 3.0 | - | 1.0 | - | - | - | 1.0 | 3.0 | - | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 |

PHYSICS LABORATORY**OBJECTIVES:**

- To gain practical knowledge and to co-relate with the theoretical studies.
- To achieve perfectness in experimental skills and the study of practical applications.
- To bring more confidence and ability to develop and fabricate engineering and technical equipment.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To make the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of the electrical conductivity of metals by plotting a current-voltage characteristic curve.
2. Determination of band gap of a semiconductor.
3. Determination of Fermi energy. (Measurement of Fermi energy in copper).
4. Study of I-V characteristics of solar cell and determination of its efficiency
5. Determination of electrical resistivity of metal and alloy –Carey foster Bridge.
6. Measurement of susceptibility of paramagnetic solution by Quinke's method.
7. Study of magnetic Hysteresis-B-H curve.
8. Determination of the dark resistance of light detective resister (LDR).
9. Measurement of Temperature using LM35.

TOTAL: 30 PERIODS**OUTCOMES:**

At the end of the course, the students should be able

1. To understand the functioning of various physics laboratory equipment.
2. To use graphical models to analyze the laboratory data and to solve problems individually and collaboratively.

3. Use mathematical models as a medium for quantitative reasoning and describing physical reality.
4. Access, process and analyze scientific information.
5. Solve problems individually and collaboratively.

TEXTBOOKS:

1. Wilson J.D. and Hernandez C.A., —Physics Laboratory ExperimentsII, Houghton Mifflin Company, New York, 2005.
2. S. Srinivasan, A Text Book of Practical physics, S. Sultan Chand publications. 2005
3. R. Sasikumar, Practical Physics, PHI Learning Pvt. Ltd, New Delhi, 2011.

| GE3221 | PO | | | | | | | | | | | | PSO | | | | |
|---------|----|-----|-----|---|---|---|---|---|---|----|----|----|-----|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Average | 3 | 2.4 | 2.6 | 1 | 1 | | | | | | | | | | | | |

CHEMISTRY LABORATORY: (Any five experiments to be conducted)

OBJECTIVES

- To train the students in basic experimental skills in water contaminants such as copper and chromium.
- To familiarise the students with electroanalytical techniques such as pH metry, potentiometry, and conductometry to determine impurities in aqueous solutions.
- To familiarize the students with the determination of the molecular weight of a polymer by a viscometer.
- To make the student up-to-date with the properties and nature of alloys experimentally.

- To demonstrate the analysis of coal.

LIST OF EXPERIMENTS: (Any five experiments to be conducted)

1. Estimation of copper content of the given solution by Iodometry.
2. Determination of strength and amount of acids in a mixture of acids using a conductivity meter.
3. Determination of strength and amount of HCl present in the whole of the given solution using a conductivity meter.
4. Estimation of the iron content of the given solution using a potentiometer.
5. Determination of chromium by EDTA titration.
6. Determination of strength of given hydrochloric acid using a pH meter.
7. Determine the molecular weight of the polyvinyl alcohol using an Ostwald viscometer.
8. Estimation of Nickel in steel.
9. Proximate Analysis of Coal.
10. Corrosion experiment-weight loss method.
11. Determination of COD value of industrial effluents.

TOTAL: 30 PERIODS

OUTCOMES

At the end of the course, the student should be able:

1. To find the quality of water samples for copper and chromium present in water.
2. To recognize the amount of various ions present in the water sample through volumetric and instrumentation techniques.
3. To identify the molecular weight of the polymer using an Ostwald viscometer.
4. To recognize an environmental hazardous and threshold limit for industrial effluents.
5. To recommend quality of coal and steel when it is exposed to various environment.

TEXT BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th Edition, 2014).
2. Suchi Tiwari, Engineering Chemistry Lab Manual, Scitech Publications (India) Pvt. Ltd. (2nd Edition, 2013).
3. Pushpendra Kumar, Laboratory Manual for Engineering Chemistry, Reyansh Authortopic Pvt. Ltd., (1st Edition, 2022).

| GE3221 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|-----|---|---|-----|-----|-----|-----|---|----|----|----|-----|-----|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | 1 | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - |
| CO5 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Average | 2 | 1.4 | 1 | 1 | 1.2 | 0.4 | 0.6 | 0.4 | - | - | - | - | - | 0.4 | - | - |

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.
- Knowing about Object Oriented Concepts.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number. (Newton's method)
3. Find exponentiation of a number. (power of a number)
4. Find the maximum of a list of numbers.
5. Program for basic calculator operations using functions.
6. Generate Fibonacci series using function.
7. Program for Armstrong number.
8. Program for check the number is Palindrome or Not.
9. Program for sum of array of numbers.
10. How to create, slice, change, add, delete and index elements using list.
11. Linear search and Binary search.
12. Find First n prime numbers.
13. Program to remove duplicate elements from a list.
14. Program for addition and transpose of a matrix.
15. How to create, slice, change, delete and index elements using Tuple.
16. Write a program to reverse the string.
17. How to change, delete, add and remove elements in Dictionary.
18. Create a dictionary of radius of circle and its circumference.
19. Program for count the number of words in a file.

- 20. Find the most frequent words in a text read from a file.
- 21. Program for student information system using class and objects.
- 22. Program for Employee Payroll Processing using class and objects.

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

| GE3232 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|----------|------------|------------|----------|----------|----------|----------|----------|------------|----------|----------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | 3 | 2 | 1 | 3 | - | - |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | 3 | 2 | - | - | 2 | - |
| CO3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | - | 3 | | 2 |
| CO4 | 3 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | - | - | - | 1 | - |
| CO5 | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 1 | - | 2 | 2 |
| CO6 | 2 | - | - | - | 2 | - | - | - | - | - | 1 | - | 1 | - | 1 | - |
| Average | 2.3 | 2.5 | 3 | 2.7 | 1.8 | 0 | 0 | 0 | 0 | 0 | 1.5 | 2 | 2 | 0 | 2 | 1 |

Unit – 1 : NATIONAL SERVICE SCHEME (NSS)**Objectives:**

The main objectives of this course are:

- To help learners know about NSS in the context of youth, community and voluntary service.
- To teach the importance of health, hygiene and sanitation for a healthy Nation.
- To understand the community in which they work.
- To identify the problems of the community and involve them in problem-solving.
- To develop the capacity to meet emergencies and natural disasters.
- To practice the National integration and social harmony.
- To utilize their knowledge in finding practical solutions to individual and community

Credit:

| Total Lecture Hours / Semester | Total Tutorial Hours / Semester | Total Practical Hours / Semester | Credit |
|--------------------------------|---------------------------------|----------------------------------|--------|
| 6 | 0 | 18 | 1* |

* To be conducted after college hours and week ends

Outcome:

Learners will have the knowledge about NSS and its role in the fields of health, hygiene, emergencies & natural disasters and involve them in problem-solving of the nearest community so as to build a strong country.

Syllabus:

Semester : I&II Attendance weightage : 50 Activities weightage : 50

Topic - I : Introduction and Basic Concepts of NSS**[8]**

- a. History – Aim – Objectives of NSS

- b. Emblem – Motto – Badge - Song
- c. Organizational structure - Roles and Responsibilities of NSS
- d. Regular activities
- e. Any approved indoor / outdoor programs by the Principal

Topic-II : Youth Leadership, Social Harmony and National Integration [8]

- a. Meaning and types of Leadership
- b. Qualities of good leaders and leadership
- c. Importance and role of youth leadership
- d. Role of youth in peace and Nation building
- e. Any approved indoor / outdoor programs by the Principal

Topic-III : Health, Hygiene and Sanitation and Youth Health [8]

- a. Definition, Needs and Scope of Health Education
- b. Swachh Bharat Abhiyan
- c. Healthy Lifestyles
- d. HIV, AIDS, Drugs abuse
- e. Any approved indoor / outdoor programs by the Principal

Topic-IV : Environment Issues, Emergencies and Disaster Management [8]

- a. Environment conservation, enrichment and sustainability
- b. Waste management
- c. Natural resource management [Rain water harvesting and Energy conservation]
- d. Introduction to Disaster Management, Classification of Disasters
- e. Any approved indoor / outdoor programs by the Principal

References:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. National Youth Policy, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
3. <https://nss.gov.in/>

NSS/NCC/NSO/YRC & CLUB ACTIVITIES

National Sports Organization (NSO)

OBJECTIVES:

1. To create awareness about basic fitness and mental strength
2. To promote the development of physical fitness
3. To develop the sporting activities of the youth
4. To create the social responsibilities and social interaction through participation

ACTIVITIES 5

INTRODUCTION - Introduction of NSO & Physical Fitness and games Skills Test (1)

PHYSICAL FITNESS ACTIVITIES - Importance of Basic Physical Fitness - BMI Calculation - Identification of deformities, (2)

SPORTS PRACTICE - Games and fitness activities Physical Fitness Activities (2)

COURSE OUTCOMES:

- Get basic knowledge about physical and mental fitness
- NSO create self-esteem and self confidence
- NSO provide opportunity get social interaction
- Development of character and personality through participation

REFERENCES:

1. www.google.com
2. <https://scholar.google.com/>
3. <https://www.medindia.net/patients/lifestyleandwellness/five-essential-components-of-physical-fitness-references.htm>
4. <https://pubmed.ncbi.nlm.nih.gov/>

NSS/NSO/YRC & CLUB ACTIVITIES

YOUTH RED CROSS – Social Service based activities

OBJECTIVES:

- To enhance the societal awareness
- To upgrade the Personality

ACTIVITIES

5

1. **HEALTH PROMOTION**- Activities that promotes health **(2)**
2. **SOCIETAL SERVICE**-Social Service activities **(2)**
3. **FRIENDSHIP BUILDING** - Friendship building activities between communities **(1)**

COURSE OUTCOME

1. Enhanced Social Awareness
2. Personality development of the individual

REFERENCES:

1. IRCS/YRC Handbook
2. <https://www.indianredcross.org/youth/Guidelines-for-JYRC-LR.pdf>

NSS/NSO/YRC & CLUB ACTIVITIES

தமிழ் மன்றம்

பாடத்திட்டத்தின் நோக்கங்கள்

- மாணவர்களை சிறந்த மேடைப்பேச்சாளர்களாக உருவாக்குவது
- தாய்மொழியின் மேன்மையை பாதுகாப்பது..

பயிற்சித்திட்டம்

1. பேச்சுக்கலைப் பயிற்சி
2. கவிதை மற்றும் கட்டுரைகள் எழுதும் பயிற்சி
3. அறிவியல் பொறியியல் தொழில்நுட்பங்களைத் தமிழில் எழுதுதல்.
4. பட்டிமன்ற மேடைகளில் பேசும் பயிற்சி.
5. நாட்டுப்புறப்பாடல்கள் பாடுதல் மற்றும் கதைகள் எழுதும் பயிற்சி.

கற்றல் முடிவு

1. பேச்சுக்கலைப் தேர்ச்சி
2. நாட்டுப்புறப்பாடல்கள் பற்றிய புரிதல்

மேற்கோள்கள்

1. <https://eegarai.darkbb.com/t63483-topic>
2. <https://poriyari.in/>

RESONANCE – SKILL BASED ACTIVITIES

OBJECTIVES:

- To know the basics and general principles of Physics.
- To provide knowledge of the current trends in Physics.
- To develop a solid scientific and technical competence for investigating and applying the relationships of Physics *phenomena in* various fields of Physics.

ACTIVITIES

5

1. **QUIZ** - Basics and general principle (1)
2. **PAPER PRESENTATION** - Current trends (2)
3. **PROJECTS** - Fun with Physics (2)

COURSE OUTCOME

Students were able to:

- Recollect the general principles of Physics.
- To explore the topics in the current trends in Physics.
- *Develop practical expertise in various areas of Physics.*

REFERENCES:

1. Principles of Physics, 10Ed, Isv by Robert Resnick Jearl Walker, David Halliday (2015)
2. 'The Feynman Lectures on Physics' (Volume I, II and III) , Matthew Sands, Richard Feynman, and Robert B. Leighton.
3. <https://www.science-sparks.com/top-5-physics-experiments-you-can-try-at-home>
4. <https://www.electronicsforu.com/category/electronics-projects/hardware-diy>.

NSS/NCC/NSO/YRC & CLUB ACTIVITIES

Eclectic Lingua – Skill based activities

OBJECTIVES:

- To enhance the communicative competence of the first-year engineering students by means of creating opportunity for impromptu/ /spontaneous speeches.
- To upgrade the English language skills of students by introducing appropriate vocabulary in different situations.

ACTIVITIES

5

1. **Extempore-** Giving expression to thoughts **(2)**
2. **Building Vocabulary-**Using relevant set of words for different contexts **(2)**
3. **Pronunciation-** Speaking accurately and fluently **(1)**

COURSE OUTCOME

1. To enable students to express themselves easily and coherently.
2. To help students to speak the language using the right words and pronouncing them correctly.

References

<https://www.cambridgeenglish.org/learning-english/activities-for-learners/?skill=pronunciation>

<https://www.quillsandquotes.ca/post/12-fun-games-to-get-students-public-speaking>

NSS/NCC/NSO/YRC & CLUB ACTIVITIES

EULER.COM – Skill based activities

OBJECTIVES:

1. To enhance the Logical reasoning of the first-year engineering students by means of creating opportunity to improve the aptitude skill.
2. To explore the applications of Mathematics in the field of Engineering, Science and Technology and to utilize this skill for their academic activities.

ACTIVITIES

5

1. **OLYMPIAD-** The students will be provided with 25 questions in Engineering Mathematics. This should be completed in one hour. **(1)**
2. **MATHEMATICAL MODELLING-** The students are expected to present physical models (Working as well as static models) based on the application of Engineering Mathematics **(2)**
3. **PAPER PRESENTATION-** Students will be provided 5-7 minutes of time to present their findings in application of Mathematics. **(2)**

COURSE OUTCOME

1. To enable students to explore their mathematical reasoning skills.
2. To motivate the students to apply Mathematics in Engineering and Technology and demonstrate their work by means of Physical model and present their research article.

References:

1. Advanced Engineering Mathematics , Erwin Kreyszig, 10th Edition, Wiley India Pvt Ltd.
2. <https://www.stewartcalculus.com/>

NSS/NCC/NSO/YRC & CLUB ACTIVITIES

Fine Arts Club VECTORIANS – Skill based activities

OBJECTIVES:

- To enhance the inbuilt talents in arts and crafts and fine arts activities.
- To explore and exhibit their qualities in cultural activities as well as in the leadership.

ACTIVITIES

5

- 1. ARTS & CRAFTS** - The students will be given with innovative Theme, they have to Show their talents in one hour time with basic facilities provided. **(1)**
- 2. SINGING & DANCING** - The students are expected to present their talents on spot or With given Theme, either solo or group performance. **(2)**
- 3. MIME & DRAMA** - Students will be given 5 - 7 minutes of time to present their variety Entertainments in way of Mono acting or Drama . **(2)**

COURSE OUTCOME

1. To enable students to explore their inbuilt talents in fine arts activities.
2. To motivate the students to show case their cultural and leadership qualities.

REFERENCES:

1. <https://www.youtube.com/watch?v=1mkESRWiSKc> – Teach your own crafts.
2. <https://www.youtube.com/watch?v=YHqwrDGywH4> – How to teach Arts & Crafts

NSS/NCC/NSO/YRC & CLUB ACTIVITIES

Catalysis – Skill-based activities

Objectives:

- To inculcate a scientific attitude and temper.
- To provide an opportunity to develop constructive, explorative & inventive ideas among the students.
- To develop training in the scientific method of problem-solving for engineering

1. **Quiz/debate-** the latest advancement in Chemistry towards engineering (2)
2. **Essay competition/Chart preparation** - Environmental sustainability (2)
3. **Nature Study - field visit to eco-parks etc.** (1)

COURSE OUTCOME

1. To promote inquisitiveness among the students and inculcate Scientific mind mapping.
2. To develop students, interest and participation in the practical applications of the knowledge related to environmental sciences.
3. Take part in practical, hands-on science activities close to nature.

REFERENCE

1. M. Senapati, Advanced Engineering Chemistry, Infinity science press, New Delhi, 2007.
2. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/environmental-sustainability>
[https://www.indiabix.com/general-knowledge/chemistry.](https://www.indiabix.com/general-knowledge/chemistry)

UNIT-V: Z – TRANSFORMS AND DIFFERENCE EQUATIONS

9

Z- Transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Solution of difference equations using Z – transform.

TOTAL: 45 PERIODS

OUTCOMES:

- Understand the fundamental concept of the concepts of Partial differential Equations.
- Understand the basic concepts of mathematical principles on Fourier & Z-transforms.
- Laplace transform and inverse transform of simple functions, properties, are studied.
- Apply the concept of Understand the concept Fourier series and apply the concept in solving PDE.
- Understand the fundamental concept of the concepts of Solution of difference equations

TEXT BOOKS:

1. Veerarajan. T., “Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G “Advanced Mathematics for Engineering Students” Vol. II & III, S. Viswanathan Publishers Pvt. Ltd.1998.

REFERENCE BOOKS:

1. Bali.N.P and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana.B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company Limited, NewDelhi, 2008.

3. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2007.5. Ray Wylie. C and Barrett.L.C, “Advanced Engineering Mathematics” Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. P.Sivaramakrishna Das, C.Vijayakumari, Transforms and Partial Differential Equations, Pearson India Education Services Pvt. Ltd, 2019.

| | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|---|---|------------|---|---|---|---|----|----|------------|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - |
| CO2 | 3 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - |
| CO3 | 3 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - |
| CO4 | 3 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - |
| CO5 | 3 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - |
| Average | 3.0 | 3.0 | - | - | 1.0 | - | - | - | - | - | - | 1.0 | - | - | - | - |

COURSE OBJECTIVES:

To impart knowledge on the following topics

- To learn the use of analytical techniques for analyzing forces in Statically determinate structures
- To introduce the equilibrium of rigid bodies
- To study and understand the distributed forces, surface, loading on beam and stress distribution
- To know about the bending theory.
- To understand the concept of slope and deflection.

UNIT I: STATICS OF PARTICLES**9**

Fundamental Concepts and Principles, Systems of Units, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components. Equilibrium of a Particle - Newton's First Law of Motion, Free-Body Diagrams.

UNIT II: EQUILIBRIUM OF RIGID BODIES**9**

Moment of a Force about a Point, Varignon's Theorem, Resolution of a Given Forces, Moment of a Forces & Couple, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III: DISTRIBUTION AND TRANSFER OF LOADS IN BEAMS**9**

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Distributed Loads on Beams, Centre of Gravity & Centroid of a Volume. Moments of Inertia of Areas - Polar Moment of Inertia, Radius of Gyration of an Area, Parallel & Perpendicular axis Theorem. Stresses in simple and compound bars — Elastic constants.

UNIT IV: BENDING OF BEAMS**9**

Types of beams and transverse loadings, Shear force and bending moment for simply supported, cantilever and over-hanging beams. Theory of simple bending — Bending stress distribution – Shear stress distribution.

UNIT V: DEFLECTION OF BEAMS**9**

Double Integration method – Macaulay's method – Moment Area method – Conjugate beam method - Strain energy methods for determinate beams.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

On successful completion of this course, students will be able to:

- Illustrate the scalar representation of forces.
- Analyse the rigid body in equilibrium and moment of forces.
- Evaluate the distribution of loads and simple stresses.
- Determine concept Shear force and theory of simple bending.
- Calculate the slope and deflection of beams by different methods.

TEXT BOOKS:

1. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.
2. Rattan, S.S. "Strength of Materials", McGraw-Hill Education, New Delhi, 3rd Edition, 2016.
3. Bansal. R.K. "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 5th Edition, 2022.
4. Rajput. R.K "Textbook of Strength of Materials ", S. Chand and Co, New Delhi, &th Edition, 2022.
5. Mubeen, Abdul, "Mechanics of Solids", Pearson Education India, New Delhi, 2017

REFERENCES:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell,

Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11th Edition, 2017.

2. Khurmi, R.S., & Khurmi, N. "A Textbook of Strength of Materials (Mechanics of Solids)", S. Chand Publishing, New Delhi, 26th Edition, 2019.
3. Raj, P. Purushothama, & Ramasamy, V. "Strength of Materials", Pearson Education India, New Delhi, 1st Edition, 2015.
4. Mott, Robert L., & Untener, Joseph A. Applied Strength of Materials, 6th Edition, CRC Press, Boca Raton, FL, 2018
5. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5th Edition, McGraw Hill Higher Education, 2019 Edition.

| CE3361 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|----------|---|---|---|---|----|----|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 2 | 3 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 2 | 3 | 1 | 1 | 2 |
| CO3 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 2 | 3 | 1 | 1 | 2 |
| CO4 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 1 | 1 | 2 |
| CO5 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 1 | 1 | 2 |
| Average | 3.0 | 1.0 | 1.0 | 1.0 | 1 | - | - | - | - | - | - | 2.4 | 3.0 | 1.2 | 1.0 | 2.0 |

COURSE OBJECTIVES:

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics.
- To analyze and appreciate the complexities involved in solving the fluid flow Problems.
- To understand the dimensional analysis and to derive a rational equation Application of the conservation laws to flow measurements and flow through
- Pipes and forces on pipe bend.
- To understand the concepts involved in boundary layer.

UNIT-I: FLUID PROPERTIES AND FLUID STATICS**9**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids- Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers - forces on planes — centre of pressure — buoyancy and floatation.

UNIT-II: FLUID KINEMATICS AND DYNAMICS**9**

Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets. Dynamics : Application of control volume to continuity, energy and momentum – Euler’s equation of motion along a stream line – Bernoulli’s equation – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentum equation.

UNIT-III: DIMENSIONAL ANALYSIS AND MODEL STUDIES**9**

Fundamental dimensions — Dimensional homogeneity — Rayleigh’s method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.

UNIT-IV: FLOW THROUGH PIPES

9

Reynolds experiment — Laminar flow in pipes and between parallel plates — Development of laminar and turbulent flows in pipes — Darcy-Weisbach equation — Moody diagram — Major and minor losses of flow in pipes — Total energy line — Hydraulic grade line – Siphon – Pipes in series and parallel – Equivalent pipes.

UNIT-V: BOUNDARY LAYER

9

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness — Momentum integral equation — Applications — Separation of boundary layer – Drag and Lift forces

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to understand

- Basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- The problems related to equation of motion.
- Gain knowledge about dimensional and model analysis.
- Types of flow and losses of flow in pipes.
- The boundary layer problems.

TEXT BOOKS:

1. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 11th Edition 2023
2. Jain.A. K., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers Twelfth Edition, 2016.
3. Subramanya. K "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2nd Edition 2018.
4. Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi, Revised Edition 2019.
5. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines Standard

REFERENCES:

1. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
2. Kumar.K.L., "Engineering Fluid Mechanics", S. Chand Publishing, New Delhi, 2016.
3. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
4. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.
5. Ranjan Kumar, "Fluid Mechanics and Hydraulic Machines", AITBS Publishers India, New Delhi, 2021.

| CE3362 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 2 |
| Average | 2.4 | 2.0 | 1.6 | 1.0 | 2.4 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.4 | 2.2 | 2.4 | 2.8 | 2.2 | 2.4 |

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- To introduce the fundamentals of surveying, its principles, accessories for chain and ranging.
- To expose students about the concepts of compass and plane table surveying.
- To learn the various types of theodolite and modern surveying.
- To introduce the concepts of levelling.
- To impart knowledge on levelling applications.

UNIT-I: FUNDAMENTALS OF CONVENTIONAL SURVEYING**9**

Definition – Classifications – Principles – Equipment and accessories for ranging and chaining – Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits.

UNIT-II: LEVELLING**9**

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling - Contouring.

UNIT-III: THEODOLITE SURVEYING**9**

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric leveling – Single Plane method – Double Plane method.

UNIT- IV: CONTROL SURVEYING AND ADJUSTMENT**9**

Horizontal and vertical control – Methods – Triangulation – Traversing – Gale's table – Trilateration – Concepts of measurements and errors – Error propagation and Linearization – Adjustment methods - Least square methods – Angles, lengths and levelling network.

UNIT-V: MODERN SURVEYING**9**

Total Station: Digital Theodolite, Electronic Distance Measurer -- Coordinate Geometry functions – Field procedure and applications. Geographical positioning system: Advantages – System components – Signal structure – Selective availability and anti spoofing receiver components and antenna – Planning and data acquisition – Data processing – Errors – Field procedure and applications.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

At the end of this course, learners will be able to:

1. Introduce the rudiments of various surveying and its principles.
2. Imparts knowledge in computation of levels of terrain and ground features.
3. Imparts concepts of Theodolite Surveying for complex surveying operations.
4. Understand the procedure for establishing horizontal and vertical control.
5. Imparts the knowledge on modern surveying instruments.

TEXT BOOKS:

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2. R. Agor, "A Textbook of Surveying and Levelling", 12th Edition, Khanna Publishers, New Delhi, 2020.
3. S.S. Bhavikatti, "Surveying and Levelling", Volume II, 2nd Edition, WILEY INDIA,

2019.

4. Charles Davies, "Elements of Surveying and Levelling", Hansebooks, 2019.

5. RANGWALA, "Surveying and Levelling", Charotar Publishing House, 2021

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2019.

2. N. N. Basak, "Surveying & Levelling", 2nd Edition, McGraw Hill Education, New Delhi, 2017.

3. K. R. Arora, Surveying Vol I & II, Standard Book house, Seventh Edition 2019.

4. W. M. Gillespie, A Treatise on Levelling Topography and Higher Surveying, Createspace Independent Publishing Platform, 2016.

5. Arthur Thomas Walmisley, "Land Surveying and Levelling", Legare Street Press, 2022.

| CE3363 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 1 | 3 | - | 3 | 1 | 3 | 2 | 2 | 3 | 1 | 3 | 3 |
| CO2 | 2 | 3 | - | - | 1 | 2 | - | 1 | 3 | 2 | - | 2 | 2 | 3 | - | 2 |
| CO3 | 3 | 3 | - | - | 1 | 2 | - | 1 | 2 | 2 | - | 3 | 3 | 2 | 3 | 2 |
| CO4 | 2 | 2 | - | - | 1 | 1 | - | - | 3 | 3 | 2 | - | 2 | 1 | 2 | 3 |
| CO5 | 2 | 2 | - | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| Average | 2.4 | 2.5 | - | 3.0 | 1.2 | 2.0 | 2.0 | 1.5 | 2.4 | 2.4 | 2.0 | 2.3 | 2.4 | 1.8 | 2.5 | 2.6 |

COURSE OBJECTIVES:

- To develop the skills for identification of suitable construction materials for Civil Engineering Projects.
- The Knowledge about the latest construction materials used in the construction.
- The Characteristics and various properties of construction materials.
- The knowledge about the various tests to check the quality of the construction materials in field and lab.
- Gives students a comprehensive understanding of the composition, microstructure, and engineering behavior of materials used in civil engineering applications.

UNIT- I: STONES - BRICKS - CONCRETE BLOCKS - LIME**9**

Stone as building material - criteria for selection - Tests on stones - Bricks - Classification - Manufacturing of clay bricks - Tests on bricks - Compressive strength - Water Absorption - Efflorescence - Bricks for special use - Lime - Preparation of lime mortar — Concrete Solid and hollow blocks - Lightweight concrete blocks.

UNIT-II: CEMENT – AGGREGATES – MORTAR**9**

Cement — Ingredients — Manufacturing process — Types and Grades — Properties of cement and Cement mortar – Tests on Cement - Fly ash – Properties of fine and coarse aggregates —Bulking of sand.

UNIT-III: CONCRETE**9**

Concrete – Ingredients - Manufacturing Process - Batching plants – RMC - Properties of fresh concrete - Slump , Flow and Compaction factor - Properties of Hardened concrete — Non-destructive testing - Mix Specification - Mix proportioning - BIS method - High Strength Concrete and High Performance Concrete - Self Compacting Concrete.

UNIT-IV: TIMBER AND OTHER MATERIALS

9

Timber - Market forms - Plywood - Veneer - False ceiling materials - Laminates - Steel - Mechanical treatment - Aluminum and Other Metallic Materials - Uses - Market forms - Paints — Varnishes — Distempers — Bitumens.

UNIT-V: MODERN MATERIALS

9

Glass – Ceramics – Sealants for joints – Glass fibre reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, learners will be able to:

- Able to identify the good quality of brick for construction purposes.
- Design the concrete mixes for different exposure conditions.
- Understand material properties of cement and aggregates.
- Study the market forms of timber and steel.
- Identify the modern construction materials for various applications.

TEXT BOOKS:

1. Varghese.P.C, Building Construction, Second Edition PHI Learning Ltd., 2016.
2. Shetty.M.S., Concrete Technology (Theory and Practice), S Chand and company limited. 8th Edition, 2013.
3. S.S. Bhavikatti, “Concrete Technology, Dreamtech Press, 2019.
4. IS 10262 – 2019, “ Concrete Mix Proportioning – Guidelines”, BIS, 2019.
5. M. S. Shetty & A. K. Jain, “Concrete Technology Theory And Practice”, 8 Edition, 2022.

REFERENCES:

1. Arora S.P and Bindra S.P Building construction, Dhanpat Rai and sons,1997.
2. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building construction, Laxmi publication (p)ltd ,Eleventh 2016.
3. Neville A.M Properties of concrete, fourth edition, Pearson education ltd.2012.
4. Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015
5. IS 456 — 2000: Indian Standard specification for plain and reinforced concrete, 2011.
6. IS 383–1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete, 2011.
7. IS 4926 – 2003: Indian Standard specification for ready–mixed concrete, 2012.

| CE3364 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 1 | - | - | 1 | - | 3 | - | - | 2 | - | - | 3 | - | - | - |
| CO2 | 1 | - | 2 | 1 | | 2 | - | - | - | - | - | 2 | - | - | - | 2 |
| CO3 | - | - | 1 | - | 1 | - | - | 1 | - | 1 | - | - | - | 1 | - | - |
| CO4 | - | 2 | - | 2 | - | - | 2 | - | 2 | - | 3 | - | - | - | 2 | - |
| CO5 | 2 | 1 | - | - | 1 | - | - | 1 | - | - | - | - | 2 | - | - | 1 |
| Average | 1.3 | 1.3 | 1.5 | 1.5 | 1.0 | 2.0 | 2.5 | 1.0 | 2.0 | 1.5 | 3.0 | 2.0 | 2.5 | 1.0 | 2.0 | 1.5 |

COURSE OBJECTIVES:

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- To determine the permeability of soil and sketch flow net for various hydraulic structures to calculate the seepage quantity.
- To familiarize on the fundamental concepts of compaction and to estimate the settlement of soil.
- To analyze the stress distribution for different loading conditions and to determine the shear strength of the soil.
- To impart knowledge on the analysis and design of both finite and infinite slopes.

UNIT- I: SOIL CLASSIFICATION 9

History – formation and types of soil – composition - Index properties - clay mineralogy structural arrangement of grains — description — Classification — BIS — US — phase relationship.

UNIT-II: EFFECTIVE STRESS AND PERMEABILITY 9

Soil water — Static pressure in water - Effective stress — Capillary phenomena— Permeability – Factors influencing permeability of soils - Laboratory Determination and field measurement of permeability - Seepage - Flow nets.

UNIT-III: COMPACTION AND CONSOLIDATION 9

Compaction – laboratory determination - field compaction method – factors influencing compaction – Components of settlement – Factors influencing settlement – Terzaghi's one dimensional consolidation theory — Computation of rate of settlement - e-log p relationship – Computation of settlement.

UNIT-IV: STRESS DISTRIBUTION AND SHEAR STRENGTH 9

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – Use of Newmark's influence chart - Shear strength of cohesive and cohesionless soils – Mohr-Coulomb failure theory – shear strength determination.

UNIT-V: SLOPE STABILITY 9

Infinite slopes and finite slopes – Slip Circle - Friction circle method – Use of stability number – Guidelines for location of critical slope surface in cohesive and c- soil – Slope protection measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, learners will be able to:

1. Classify the soil and assess the engineering properties, based on index properties.
2. Understand the stress concepts in soils.
3. Understand and identify the settlement in soils.
4. Determine the shear strength of soil.
5. Analyze both finite and infinite slopes.

TEXT BOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi, 2018.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2020(Reprint).
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics", New Age International Publication, 3rd Edition, 2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.
5. Gopal Ranjan & A S R Rao, "Basic And Applied Soil Mechanics", New Age International Pvt Ltd, 2016.

REFERENCES:

1. Braja M Das, "Principles of Geotechnical Engineering", Cengage Learning India Private Limited, 9th Edition, 2015.
2. Utsav Chandra Kalita, Soil Mechanics and Foundation Engineering, PHI Learning, 2022.
3. Dr. T. William Lambe and Dr. Robert V. Whitman, "Soil Mechanics", Wiley, 2020.
4. Dr. R.D. Holtz, W.D. Kovacs, and T.C. Sheahan, An Introduction to Geotechnical Engineering, Pearson, 2022.
5. Dr. R.F. Craig, Soil Mechanics, 8th Edition, Spon Press, 2021.

| CE3365 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 1 | 1 | - | 1 | 1 | - | 1 | 2 | - | 3 | 1 | - | 1 | 3 |
| CO2 | 2 | 3 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 2 | 3 | - |
| CO3 | 3 | 3 | 2 | 3 | - | 3 | - | - | - | - | 1 | - | 1 | 1 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | 1 | 1 | 2 | - |
| CO5 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | 2 | 2 | 1 |
| Average | 2.6 | 2.6 | 2.2 | 2.0 | 1.0 | 1.7 | 1.5 | 1.0 | 1.0 | 2.0 | 1.0 | 2.5 | 1.3 | 1.5 | 2.0 | 2.3 |

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- To train the student to acquire skill on chain and compass surveying.
- To train students to gain experience on plane table surveying.
- To have hands on experience on operating theodolite.
- To gain practical knowledge on levelling.
- To gain practical knowledge on total station.

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking
Perpendicular offset

Compass Survey

2. Compass Traversing — Measuring Bearings & arriving included angles
Levelling
- Study of levels and levelling staff
3. Fly levelling using Dumpy level & Tilting level
4. Check leveling

Theodolite - Study of Theodolite

5. Measurements of horizontal angles by reiteration and repetition and vertical angles
6. Determination of elevation of an object using single plane method when base is
Accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

7. Determination of Tacheometric Constants
8. Heights and distances by stadia Tacheometry
9. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

10. Traverse using Total station and Area of Traverse
11. Determination of distance and difference in elevation between two inaccessible

points using Total station

12. Setting out works – Foundation marking using tapes single Room

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, learners will be able to:

1. Impart knowledge on the usage of basic surveying instruments like chain/tape, compass and levelling instruments.
2. Able to use levelling instrument for surveying operations.
3. Able to use theodolite for various surveying operations.
4. Able to carry out necessary surveys for social infrastructures.
5. Able to prepare planimetric maps.

REFERENCES:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2015.
2. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004 a. David Clark, Plane and Geodetic Surveying for Engineers, Volume I, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
5. David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, Volume II, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
6. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice 'Hall of India 2004.
7. K. R. Arora, Surveying Vol. I & II, Standard Book house, Eleventh Edition, 2013.

| CE3366 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | 1 | 1 | 3 | - | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 3 |
| CO2 | 2 | 3 | - | - | 1 | 2 | - | 1 | 3 | 2 | - | 3 | 3 | 1 | 3 | 2 |
| CO3 | 3 | 3 | - | - | 1 | 2 | - | 1 | 3 | 2 | - | 3 | 3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | - | - | 1 | 1 | - | - | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| Average | 2.6 | 2.8 | 2.0 | 2.0 | 1.2 | 2.0 | 2.0 | 1.5 | 3.0 | 2.4 | 2.0 | 2.6 | 2.8 | 1.6 | 2.6 | 2.6 |

COURSE OBJECTIVES:

To impart knowledge on the following topics

- To facilitate the understanding of the behavior cement.
- To know about the various test procedures on Fine aggregates
- To know about the various test procedures on Coarse aggregates
- To know about the various test procedures on Bricks.
- To understand applications various construction materials.

LIST OF EXPERIMENTS:**I. TESTS ON CEMENT**

- a. Determination of fineness of cement
- b. Determination of consistency of cement
- c. Determination of specific gravity of cement
- d. Determination of setting time of cement

II. TESTS ON FINE AGGREGATE

- a. Determination of specific gravity of fine aggregate
- b. Determination of grading of fine aggregate
- c. Determination of compacted and loose bulk density of fine aggregate

III. TESTS ON COARSE AGGREGATE

- a. Determination of impact value of coarse aggregate
- b. Determination of elongation index and flakiness index of coarse aggregate
- c. Determination of aggregate crushing value of coarse aggregate

d. Determination of specific gravity and water absorption of coarse aggregate

IV. TESTS ON BRICKS

a. Determination of compressive strength of bricks

b. Determination of water absorption and efflorescence of bricks

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

| Sl.No. | Description of Equipment | Quantity |
|--------|------------------------------------|----------|
| 1. | Vicat Apparatus | 1 |
| 2. | Le chatelier Apparatus | 1 |
| 3. | Pycnometer | 1 |
| 4. | Weighing Balance | 1 |
| 5. | Compression testing machine | 1 |
| 6. | Aggregate impact testing machine | 1 |
| 7. | Length Gauge | 1 |
| 8. | Thickness Gauge | 1 |
| 9. | Aggregate Crushing Value Apparatus | 1 |
| 10. | Trowels and planers | 1 Set |
| 11. | Sieves | 1 Set |

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. The students will have the required knowledge in the area of testing of construction materials.

2. Will be able to test the quality of cement.
3. Will be analyze the properties of fine aggregate.
4. Will be analyze the properties of coarse aggregate.
5. Will be able to test brick's quality.

REFERENCES:

1. Construction Materials Laboratory Manual, Anna University, Chennai-600 025.
2. IS 4031 (Part 1) – 1996 – Indian Standard Method for determination of fineness by dry sieving.
3. IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for concrete.
4. IS 383 — 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

| CE3367 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|---|---|---|---|------------|------------|------------|------------|------------|------------|------------|---|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | - | - | 2 | 1 | 2 | 2 | 0 | 2 | 2 | - | 1 | 3 |
| CO2 | 3 | - | - | - | - | - | 2 | 1 | 2 | 0 | 0 | 2 | 2 | - | 1 | 3 |
| CO3 | 3 | 2 | - | - | - | - | 0 | 1 | 2 | 0 | 2 | 0 | 2 | - | 1 | 3 |
| CO4 | 3 | 2 | - | - | - | - | 2 | 1 | 2 | 0 | 0 | 2 | 2 | - | 1 | 3 |
| CO5 | 3 | - | - | - | - | - | 2 | 1 | 2 | 2 | 0 | 2 | 2 | - | 1 | 3 |
| Average | 3.0 | 2.0 | - | - | - | - | 1.6 | 1.0 | 2.0 | 0.8 | 0.4 | 1.6 | 2.0 | - | 1.0 | 3.0 |

COURSE OBJECTIVES:

- To develop skill to use software to create 2D and 3D models.
- To apply basic concept to drawing, edit, dimension, hatching etc., to develop 2D&3D Modelling
- To Understand and interpret the engineering drawings.
- To introduce standards and codes to produce engineering drawings.
- To provide hands on training to become proficient with 2D Computer Aided drafting of simple objects.

LIST OF EXPERIMENTS:

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems.
2. Creation of simple figures like polygon and general multi-line figures and Title Block with necessary text, projection and symbols.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views.
6. Drawing sectional views of prism, pyramid, cylinder, cone, etc
7. Drawing isometric projection of simple objects
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-Dmodel
9. Drawing of a plan of residential building.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

| Sl.No. | Description of Equipment | Quantity |
|--------|---|-------------|
| 1. | Pentium IV computer or better hardware, with suitable graphics facility | 30 No. |
| 2. | Licensed software for Drafting and Modeling. | 30 Licenses |
| 3. | Laser Printer or Plotter to print / plot drawings | 2 No |

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. The students will have the required knowledge in the area of 2D & 3D Views using computer aided drafting software.
2. Will be able to construct accurate 2D geometry as per the dimensions following standard drawing practices with proper dimensioning using Computer Aided drafting software.
3. Will be able to develop isometric drawings views using Computer Aided drafting software
4. Will be understand the Create 2D representations of 3D objects as plan view, elevations, side views and sections / auxiliary views using Computer Aided drafting software
5. Will be able to standard drawing codes and practices which is required for producing engineering drawings.

TEXTBOOKS:

1. Sikka V.B., A Course in Civil Engineering Drawing, 4th Edition, S.K.Kataria and Sons, 2015.
2. George Omura, Mastering in Autocad 2005 and Autocad LT 2005– BPB Publications, 2008.

REFERENCES:

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, BIM Handbook: A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors, John Wiley and Sons. Inc.,2011.
2. Marimuthu V.M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, PratheebaPublishers, 2008.
3. Vijay Duggal, "A general guide to Computer Aided Design & Drafting", Mailmax Publications, 2000.

| CE3368 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|---|---|---|-----|-----|---|---|-----|----|----|-----|-----|---|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 3 | 2 | - | - | 2 | - | - | 1 | 2 | - | 1 | 3 |
| CO2 | 3 | - | - | - | 3 | 2 | - | - | 2 | - | - | 1 | 2 | - | 1 | 3 |
| CO3 | 3 | - | - | - | 3 | 1 | - | - | 2 | - | - | 1 | 2 | - | 1 | 3 |
| CO4 | 3 | - | - | - | 3 | 2 | - | - | 2 | - | - | 1 | 2 | - | 1 | 3 |
| CO5 | 3 | - | - | - | 3 | 3 | - | - | 2 | - | - | 1 | 2 | - | 1 | 3 |
| Average | 3.0 | - | - | - | 3.0 | 2.0 | - | - | 2.0 | - | - | 1.0 | 2.0 | - | 1.0 | 3.0 |

OBJECTIVES:

- To familiarize the students with ordinary differential equations
- To develop the use of ordinary differential equations that is needed by engineers for practical application.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems?
- To acquaint the student with Fourier series techniques in solving one dimensional wave equations used in various situations.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.

UNIT- I : ORDINARY DIFFERENTIAL EQUATIONS**6**

Higher order linear differential equations with constant coefficients – Method of variation of parameters.

UNIT- II : APPLICATION OF ORDINARY DIFFERENTIAL EQUATIONS**6**

Solution of ODE related to bending of beams, motion of a particle in a resisting medium and simple harmonic motion.

**UNIT- III : APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS - ONE
DIMENSIONAL WAVE EQUATIONS****6**

Classification of PDE - Solutions of one dimensional wave equation.

**UNIT- IV: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS - ONE
DIMENSIONAL HEAT EQUATIONS****6**

One dimensional equation of heat conduction- Zero to zero- Non zero to zero —
Non zero to non zero boundary conditions.

**UNIT- V: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS-TWO
DIMENSIONAL HEAT EQUATIONS**

6

Steady state solution of two dimensional equation of heat conduction in infinite plates (excluding insulated edges) and circular plates only.

TOTAL: 30 PERIODS

OUTCOMES:

1. Understand how to solve the given ordinary differential equations.
2. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
3. Appreciate the physical significance of Fourier series techniques in solving one dimensional wave equations.
4. Appreciate the physical significance of Fourier series techniques in solving one dimensional heat flow problems.
5. Appreciate the physical significance of Fourier series techniques in solving two dimensional heat flow problems.

TEXT BOOKS:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S. Viswanathan Publishers Pvt. Ltd.1998.

REFERENCE BOOKS:

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition,Laxmi Publications Pvt Ltd, 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.

4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.

| MA3421 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|---|---|---|---|---|---|----|----|-----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| Average | 3.0 | 3.0 | 3.0 | - | - | - | - | - | - | - | - | 1.0 | - | - | - | - |

COURSE OBJECTIVES:

To impart knowledge on the following topics

- To understand about theory of torsion and deflection of springs.
- To understand the method of finding the unknowns in indeterminate beams
- To estimate the various states of stresses and study about the failure theories.
- To estimate the load carrying capacity and failure modes of columns and cylinders.
- To learn unsymmetrical bending and analyze plane trusses.

UNIT - I: TORSION & SPRINGS**9**

Theory of Torsion — Stresses and Deformations in Solid and Hollow Circular Shafts — combined bending moment and torsion of shafts - Closed and Open Coiled helical springs.

UNIT- II: INDETERMINATE BEAMS**9**

Propped cantilever and fixed beams - fixed end moments and reactions — sinking and rotation of supports - Theorem of three moments — analysis of continuous beams — shear force and bending moment diagrams.

UNIT - III: STATE OF STRESS**9**

State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes - Theories of failures - Mohr's circle method - Stress tensor — Stress invariants - Volumetric strain.– Application problems.

UNIT - IV: COLUMNS & CYLINDERS**9**

Euler's column theory – critical load for prismatic columns with different end conditions - Rankine-Gordon formula - Eccentrically loaded columns – core of a section – Thin and

thick cylinders.

UNIT - V: TRUSSES AND UNSYMMETRICAL BENDING

9

Analysis of pin jointed plane determinate trusses by method of joints and method of sections. Unsymmetrical bending of beams - Shear Centre.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

1. Solve for torsion problems and deflection of springs
2. Analyze indeterminate beams for external loadings and support settlements.
3. Determine principal stresses in 2-D state and analyze various theories of failures.
4. Find the load carrying capacity & stresses in columns and cylinders.
5. Analyze pin jointed trusses.

TEXT BOOKS:

1. Bansal. R.K. "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 5th Edition, 2022.
2. Rajput. R.K "Textbook of Strength of Materials ", S. Chand and Co, New Delhi, &th Edition, 2022
3. Khurmi, R.S., & Khurmi, N. "A Textbook of Strength of Materials (Mechanics of Solids)", S. Chand Publishing, New Delhi, 26th Edition, 2019.
4. Shah, H.J., "Mechanics of Solids", Charotar Publishing House, Anand, 2023.
5. Khurmi, R.S., & Khurmi, N. "A Textbook of Strength of Materials (Mechanics of Solids)", S. Chand Publishing, New Delhi, 26th Edition, 2019

REFERENCES:

1. Raj, P. Purushothama, & Ramasamy, V. "Strength of Materials", Pearson Education India, New Delhi, 1st Edition, 2015.
2. Rattan . S. S, "Strength of Materials", Tata McGraw Hill Education Private

Limited, New Delhi, 3rd Edition, 2016.

3. Singh. D.K., —Strength of MaterialsII, Ane Books Pvt. Ltd., New Delhi, 2016

4. 5.Timoshenko S, “Strength Of Materials”, 3E, Part 1 (Pb), 2021.

5. Mott, Robert L., & Untener, Joseph A. Applied Strength of Materials, 6th Edition, CRC Press, Boca Raton, FL, 2018.

| CE3461 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|---|---|---|---|----|----|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 3 | 2 | - | 1 | - | - | - | - | - | - | 2 | 2 | 2 | 1 | 1 |
| CO2 | 2 | 3 | 2 | - | 1 | - | - | - | - | - | - | 2 | 3 | 1 | 1 | 1 |
| CO3 | 2 | 3 | 2 | - | 1 | - | - | - | - | - | - | 2 | 2 | 2 | 1 | 1 |
| CO4 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 2 | 1 | 2 |
| CO5 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 1 | 1 | 2 |
| Average | 2.0 | 3.0 | 2.0 | 1.0 | 1.0 | - | - | - | - | - | - | 2.4 | 2.6 | 1.6 | 1.0 | 1.4 |

COURSE OBJECTIVES:

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
- Application of the law of energy principle applicable to gradually varied flow.
- Application of the law of conservation of laws to momentum applicable to rapidly varied flow.
- To understand the concepts and basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine.
- To understand the concepts and basic principles of working of hydraulic machineries and to design Centrifugal and Reciprocating pumps.

UNIT- I: UNIFORM FLOW**9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow - Velocity distribution in open channel - Steady uniform flow - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force, Weir and Notches -Types.

UNIT- II: VARIED FLOWS**9**

Dynamic equations of gradually varied flow- Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method - Change in Grades.

UNIT- III: RAPIDLY VARIED FLOWS**9**

Application of the momentum equation for Rapidly varied flow - Hydraulic jumps - Types - Energy dissipation – Celerity - Positive and Negative surges.

UNIT- IV: TURBINES

9

Impact of Jet on flat, curved plates, Stationary and Moving - Turbines - Classification - Impulse turbine — Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed — Minimum Speed to start the pump.

UNIT-V: PUMPS

9

Classification of Pumps- Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work done- Gear pump.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, learners will be able to:

1. Describe the basics of open channel flow, its classification and analysis of uniform flow in steady state conditions with specific energy concept and its application
2. Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.
3. Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
4. Design turbines and explain the working principle
5. Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.

TEXT BOOKS:

1. Dr. R. K. Bansal.,A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications, Tenth edition,2019
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017.

3. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.
4. Purusothama Raj P & Ramasamy V, Applied Hydraulic Engineering, Scitech Publications (India) Pvt. Ltd., 2018.
5. John A. Roberson, John J. Cassidy & M. Hanif Chaudhry, Hydraulic Engineering, 2nd Edition, Wiley India Pvt. Ltd., 2023

REFERENCES:

1. VenTe Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 22nd edition, 2019.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019.
4. Frank M. White., Fluid Mechanics, Tata McGraw Hill, New Delhi, 2022.
5. Subramanya K., Fluid Mechanics and Hydraulic Machines-Problems and Solution, Tata McGraw Hill, New Delhi, 2018.
6. Prof. M. Vivekanandhan & Prof. Gowri Sankar, Applied Hydraulic Engineering, ARS Publications, 2021

| CE3462 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 2 |
| Average | 3.0 | 3.0 | 2.0 | 1.6 | 1.0 | 2.0 | 2.0 | 1.0 | 2.0 | 1.0 | 1.0 | 3.0 | 2.2 | 2.4 | 2.8 | 2.2 |

COURSE OBJECTIVES:

- The various construction techniques used in the construction field.
- The latest construction practices used in the construction.
- The various construction methods for the sub-structure used in the construction sites.
- The knowledge about the various construction procedures for super-structure such as bridge deck, offshore structures, domes etc.
- The various equipments needed for construction of various types of structures to handle the materials.

UNIT- I : CONSTRUCTION TECHNIQUES**9**

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism – floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials – responsible sourcing - Eco Building - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Building automation - Energy efficient buildings for various zones.

UNIT- II: CONSTRUCTION SEQUENCES**9**

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – weather and water proof – roof finishes.

UNIT- III : CONSTRUCTION OF SUB STRUCTURES

9

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques — Piling techniques - well and caisson - sinking cofferdam cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting well points -Dewatering and stand by Plant equipment for underground open excavation.

UNIT- IV : CONSTRUCTION OF SUPER STRUCTURES

9

Launching girders, bridge decks, off shore platforms — special forms for shells - techniques for heavy decks — in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors Erection of articulated structures, braced domes and space decks.

UNIT- V : CONSTRUCTION EQUIPMENTS

9

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end loaders, earth movers — Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures — types of cranes - Equipment for dredging, trenching and tunneling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, learners will be able to:

1. Know the different construction techniques and structural systems.
2. Understand various techniques and practices on masonry construction, flooring, and roofing.
3. Apply appropriate techniques used for sub structure construction.
4. Identify and apply different techniques for super structure construction.
5. Identify the different construction equipments for various applications.

TEXT BOOKS:

1. Arora S.P. and Bindra S.P., " The Text Book Of Building Construction ", Dhanpat Rai and Sons, 2015.
2. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2015.
3. S. C. Rangwala, Building Construction, Charotar Publishing House, 2022
4. S.S. Bhavikatti, Building Construction, Vikas Publishing House, 2014.
5. P. Purushothama Raj, Building Construction Materials and Techniques, Pearson Education India, 2016

REFERENCES:

1. Eva Kultermann & William P. Spence, Construction Materials, Methods, and Techniques: Building for a Sustainable Future, 5th Edition, Cengage Learning, 2023.
2. Dr. Manoranjan Samal, Advanced Construction Techniques and Equipment, 1st Edition, S.K. Kataria & Sons, 2022.
3. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 2023.
4. Sharma S.C. "Construction Equipment and Management" ,Khanna Publishers New Delhi, 2022.
5. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi,2023.

| CE3463 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | - | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 2 |
| CO2 | 1 | - | - | 2 | 2 | 2 | 3 | - | 1 | 1 | 2 | 1 | 3 | 2 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 2 |
| CO5 | 1 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| Average | 1.6 | 2.8 | 2.5 | 2.6 | 2.4 | 2.0 | 2.0 | 1.0 | 1.4 | 1.4 | 2.4 | 1.4 | 2.8 | 2.6 | 2.6 | 2.0 |

COURSE OBJECTIVES:

- To impart the basis of irrigation properties and estimation of crop water.
- Student is exposed to different phases in irrigation practices and irrigation project planning and development.
- Student is exposed to various types of hydraulic structure includes dams, spillways and dissipaters.
- Design the components of irrigation canal includes canal drops and cross drainage works.
- To gain the concepts of Irrigation water management.

UNIT- I: IRRIGATION AND CROP WATER REQUIREMENT**9**

Need and classification of irrigation- historical development and merits and demerits of irrigation- physical properties of the soil that influence the soil moisture characteristic - types of crops, season, duty, delta and base period- consumptive use of crops - estimation of Evapotranspiration using experimental and theoretical methods.

UNIT- II: IRRIGATION METHODS**9**

Tank irrigation — Well irrigation — Irrigation methods: Surface and Sub-Surface and Micro Irrigation design of drip and sprinkler irrigation — ridge and furrow irrigation- Irrigation scheduling – Water distribution system- Irrigation efficiencies- planning and development of irrigation projects.

UNIT- III: DAMS, DIVERSION AND IMPOUNDING STRUCTURES

9

Factors affecting the location of dam-Forces on a dam– Gravity dam -Design of Gravity dams, Earth dams, Arch dams- Spillway- Energy dissipaters. Diversion Head works - Weirs and Barrages- Types of Impounding structures.

UNIT-IV: CANAL IRRIGATION

9

Classification of canals - Canal regulations – direct sluice - Canal drop – Cross drainage works- Canal outlets — Design of prismatic canal-canal alignments-Canal lining - Kennedy 's and Lacey's Regime theory Design of unlined canal.

UNIT-V: WATER MANAGEMENT IN IRRIGATION

9

Automated Irrigation System and IoT system - Rehabilitation — Optimization of water use- Minimizing water losses- On farm development works - Participatory irrigation management - Water resources associations- Changing paradigms in water management-Performance Evaluation-Economic aspects of irrigation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. Have knowledge and skills about properties of soil and crop water requirements.
2. To understand the methods and management of irrigation
3. Gain knowledge regarding various hydraulic structures like diversion, dam and spillway structures
4. to understand the various components and design of canal and cross drainage work
5. To gain knowledge regarding the Irrigation water management, water user association for participatory irrigation management

TEXT BOOKS:

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2013.
2. Punmia B.C., et. al; "Irrigation and water power Engineering", Laxmi Publications, 17th Edition, New Delhi, 2021.
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCES:

1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005.
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc,2000.
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill Inc., New Delhi, 1997.
4. Sharma R.K. "Irrigation Engineering", S.Chand & Co. 2008.
5. Michael A.M., "Irrigation Theory and Practice", 2nd Edition, Vikas Publishing House Pvt.Ltd., Noida, UP, 2008.
6. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, New Delhi, 2000.
7. Basak, N.N, "Irrigation Engineering", Tata McGraw Hill Publishing Co. New Delhi, 2008.

| CE3464 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | - | 1 | - | - | 2 | - | - | - | - | 3 | - | - | 2 | - | - | - |
| CO2 | 3 | - | - | 2 | 3 | - | - | - | 1 | - | - | 2 | 3 | - | 2 | 2 |
| CO3 | 3 | 3 | 2 | - | - | - | - | 3 | - | - | 1 | - | - | 3 | - | - |
| CO4 | 3 | - | 3 | - | - | - | 2 | - | - | - | 1 | - | - | 3 | 3 | 2 |
| CO5 | - | - | - | 2 | 2 | 3 | - | - | 1 | 2 | 2 | 2 | - | - | - | 3 |
| Average | 3.0 | 2.0 | 2.5 | 2.0 | 2.3 | 3.0 | 2.0 | 3.0 | 1.0 | 2.5 | 1.3 | 2.0 | 2.5 | 3.0 | 2.5 | 2.3 |

COURSE OBJECTIVES:

- To impart knowledge to plan and execute a detail site investigation programme.
- To select geotechnical design parameters and type of foundations.
- To familiarize the students for the geotechnical design of different type of foundations and retaining walls.
- To know the settlement of foundations on shallow and deep foundations.
- To learn the contact pressure and settlement of foundations for various footings and rafts.

UNIT-I: SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration - Depth and spacing of bore holes – Soil samples — Sampling methods — Penetration test — Data interpretation - Strength parameters - Bore log report- Selection of foundation based on soil condition.

UNIT-II: BEARING CAPACITY AND SETTLEMENT 9

Location and depth of foundation — Codal provisions — Bearing capacity of shallow foundation on homogeneous deposits – Factors affecting bearing capacity – Bearing capacity determination – Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Seismic considerations in bearing capacity evaluation - Codal provision.

UNIT-III: SHALLOW FOUNDATION 9

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour — Applications – Codal provision.

UNIT-IV: PILE FOUNDATION**9**

Types of piles and their functions — Factors influencing the selection of pile — Load Carrying capacity of pile — Design methodology for piles - Static formula — Dynamic formulae — Capacity from insitu tests –Negative skin friction — Group capacity — Settlement of pile groups – Pile load test - Under reamed piles – Codal provisions.

UNIT-V: RETAINING WALLS**9**

Introduction- Plastic equilibrium in soils – Active and passive states – Rankine's theory — Cohesionless and cohesive soil — Coulomb's wedge theory — Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann's Graphical method.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

At the end of this course, learners will be able to:

1. Understand the site investigation, methods and sampling.
2. Get knowledge on bearing capacity and testing methods.
3. To design various types of shallow footings.
4. Determine the load carrying capacity, settlement of pile foundation.
5. Determine the earth pressure on retaining walls and analysis for stability.

TEXT BOOKS:

1. Venkatramaiah.C., "Geotechnical Engineering", New Age International Pvt. Ltd., New Delhi, 2017
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition,2017(Reprint).
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi,16th Edition,2017.
4. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS

Publishers Distribution Ltd., New Delhi, 2018.

5. Dr. P.N. MODI, “ Soil Mechanics and Foundation Engineering(Geotechnical Engineering)”, standard book house, 2019.

REFERENCES:

1. Braja M Das, —Principles of Foundation Engineeringll (8th Edition), Cengage Learning 2015.
2. Kaniraj, S.R. —Design aids in Soil Mechanics and Foundation Engineeringll, Tata McGraw Hill publishing company Ltd., New Delhi, 2015.
3. Joseph E bowles, —Foundation Analysis and designll, McGraw Hill Education, 5th Edition, 2015.
4. IS Code 6403:1981 (Reaffirmed 1997) —Bearing capacity of shallow foundationll, Bureau of Indian Standards, New Delhi.
5. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) —Shallow foundations subjected to symmetrical static vertical loadsll, Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 2):1980 (Reaffirmed 1995)llDeep foundations subjected to symmetrical static vertical loadingll, Bureau of Indian Standards, New Delhi.
7. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) —Concrete Pilesll Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) —Timber Pilesll, Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) —Under Reamed Piles, Bureau of Indian Standards, New Delhi.
10. IS Code 2911 (Part 4): 1979 (Reaffirmed 1997) —Load Test on Pilesll, Bureau of Indian Standards, New Delhi.
11. IS Code 1904: 1986 (Reaffirmed 1995) —Design and Construction of Foundations in Soillsll, Bureau of Indian Standards, New Delhi.
12. IS Code 2131: 1981 (Reaffirmed 1997) —Method for Standard Penetration test for Soillsll, Bureau of Indian Standards, New Delhi.
13. IS Code 2132: 1986 (Reaffirmed 1997), —Code of Practice for Thin — walled tube sampling for soilsll, Bureau of Indian Standards, New Delhi.
14. IS Code 1892 (1979): —Code of Practice for subsurface Investigation for

Foundations II. Bureau of Indian Standards, New Delhi.

15. IS Code 14458 (Part 1): 1998 — Retaining Wall for Hill Area —
Guidelines, Selection of Type of Wall III, Bureau of Indian Standards, New Delhi.

| CE3465 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|---|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | 2 | - | 3 | 2 | - | - | - |
| CO2 | 3 | 2 | 2 | - | - | - | 2 | 1 | - | 1 | - | 3 | 3 | 2 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 2 | - | 2 | 2 | 2 | 2 | 2 | - | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | - | 2 | 2 | 1 | - | 1 | - | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 1 | - | 2 | 2 | 2 | 3 | 2 | - | 3 | 3 | 2 | 2 | 1 |
| Average | 2.8 | 2.2 | 2.5 | 1.7 | - | 2.0 | 2.0 | 1.6 | 2.3 | 1.6 | - | 3.0 | 2.8 | 2.5 | 2.5 | 1.5 |

GE3451

NCC Credit Course Level - I

L T P C

(Common to Army, Navy & Air)

3* 0 0 3*

Objective:

- To know the basic structure of NCC and Role of NCC
- To improve the cadet's personality skill and leadership quality
- To make the interest of cadets to involve in social activities
- Preventing the potential damage and suffering
- To destruction of the enemy's ability to fight and will to fight

Unit - I : Introduction to NCC

9

Aims, Objectives & Organization of NCC, Incentives, Duties of NCC Cadet, NCC Camps and Types National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security.

Unit - II :Personality Development

9

Personal Transformation, Personal Productivity Skills - time management, organizational and planning skills, problem solving and decision-making abilities, basics of psychology, Leadership, Meditation

Unit - III : Social Service and Community Development

9

Basics, Rural Development Programmes, NGOs, Contribution of Youth, Protection of Children and Women Safety, Road / Rail Travel Safety, New Initiatives, Cyber and Mobile Security Awareness

Unit - IV : Disaster Managements and its Awareness

9

Importance of Hazards and Disaster, Types of disasters, Earthquakes and its types, flood types and its management, landside and its managements case studies of disasters in Sikkim, Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management

Unit – V : War and Peace in Contemporary World

9

Conceptual framework of War and Peace, Concepts of theories and approaches, Modern /war fare: Conventional, nuclear, Guerilla and Irregular Warfare, Limited and Specialized Warfare with reference to mountain, desert and jungle warfare, terrorism as a new mode of conflict, War as an Economic Problem, Defence and Development, Defence and Development, Defence and Development

TOTAL: 45 PERIODS

Note: NCC Credit Course Level — I is offered for NCC students only. The grades earned by the students will be recorded in the marksheet, however the same shall not be considered for the computation of CGPA

Course outcome:

At the end of the course, the student should be able to:

1. Understand their roles and responsibilities
2. Demonstrate the knowledge of human values and morals
3. Actively participate in social service and development activities
4. Understand the importance of disaster management
5. Analyse the issues related to war and its effects.

Text Books

1. R. Gupta's NCC Handbook of NCC Cadets 'A', 'B' and 'C' certificate Examiantions

Reference book:

1. V. B. RAO, Personality Development and Soft Skills, BS Publications
2. Harish K. Gupta, Disaster Management, Universities press.

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for

- To gain knowledge on the shear, compressive and tensile properties of materials.
- To understand gain knowledge on the impact and hardness properties of materials.
- To determine the deflection test on spring and steel beam.
- To understand about impact loading and testing.
- To study on various mix proportions and testing of concrete specimens.

LIST OF EXPERIMENTS:

- Tension test on steel rod
- Compression test on wood
- Double shear test on metal rod
- Torsion test on mild steel rod
- Impact test on metal specimen (Izod and Charpy)
- Hardness test on metals (Rockwell and Brinell Hardness Tests)
- Deflection test on metal beam
- Compression test on helical spring
- Mix Design as per IS Standards
- Tensile and Compressive strength test on Concrete

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

| Sl.No. | Description of Equipment | Quantity |
|--------|--------------------------------------|----------|
| 1. | UTM of minimum 40 ton capacity | 1 |
| 2. | Torsion testing machine | 1 |
| 3. | Izod & Charpy impact testing machine | 1 |
| 4. | Hardness testing machine | 1 |
| 5. | Beam deflection test apparatus | 1 |
| 6. | Spring testing machine | 1 |
| 7. | Vernier calipers | 3 |
| 8. | Dial gauge | 3 |
| 9. | Concrete cube moulds | 6 |
| 10. | Concrete cylinder moulds | 3 |
| 11. | Weighing Balance | 1 |
| 12. | Seive set | 1 |
| 13. | Trowels and planers | 1 Set |

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, learners will be able to:

1. Acquire knowledge in the area of determining the strength of various construction materials.
2. Analyze hardness of materials experimentally.
3. Analyze deflection of specimens experimentally.
4. Understand the mix proportion of concrete.

- Determine the strength of hardened concrete.

REFERENCES:

- Laboratory Manual prepared by Course Coordinator (Preferably Laboratory In-charge)
- Strength of Materials Laboratory Manual, Anna University, Chennai-600 025.
- M.S. Shetty, —Concrete Technology-Theory and Practicell, S. Chand & Company Ltd., New Delhi, 2008.
- IS 10262 - 2009 — Indian Standard methods for concrete mix proportioning - guidelines.
- IS 456 — 2000 Indian Standard for plain and reinforced concrete - Code of practice.

| CE3466 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|---|---|---|-----|-----|----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | 1 | 1 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 1 | 1 | 1 | - | - | - | 1 | 1 | - | 2 | 2 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 3 | 2 | 1 | - | - | - | 1 | 1 | - | - | 2 | 2 | 1 | 1 |
| CO4 | 3 | 3 | 3 | 2 | 1 | - | - | - | 1 | 1 | - | - | 2 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | - | 1 | 1 | - | 3 | 2 | 3 | 2 | 2 |
| Average | 3.0 | 2.4 | 2.0 | 1.6 | 1.0 | - | - | - | 1.0 | 1.0 | - | 2.0 | 2.0 | 2.4 | 1.6 | 1.4 |

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for

- To gain knowledge on the Flow measurement,
- To understand about the Losses in Pipes,
- To gain knowledge on the Working performance of Pumps,
- To gain knowledge on the Working performance of Turbine,
- To study on the Determination of Metacentric Height,

LIST OF EXPERIMENTS:**A. FLOW MEASUREMENT**

1. Calibration of Rotameter
2. Flow through Orifice meter/mouthpiece, Venturimeter and Notches
3. Bernoulli's Experiment

B. LOSSES IN PIPES

4. Determination of friction factor in pipes.
5. Determination of minor losses

C. PUMPS

6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Reciprocating pump

D. TURBINES

9. Characteristics of Pelton wheel turbine
10. Characteristics of Francis turbine
11. Characteristics of Kaplan turbine

E. DETERMINATION OF METACENTRIC HEIGHT

12. Determination of metacentric height of floating bodies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. Apply Bernoulli equation for calibration of flow measuring devices.
2. Measure friction factor in pipes and compare with Moody diagram.
3. Determine the performance characteristics of rotodynamic pumps.
4. Determine the performance characteristics of positive displacement pumps.
5. Determine the performance characteristics of turbines.

REFERENCES:

1. Laboratory Manual prepared by Course Coordinator(Preferably Laboratory In-charge)
2. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015.
3. Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd. 2011 Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2017.

| CE3467 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 2 |
| Average | 3.0 | 2.4 | 2.0 | 1.6 | 1.0 | 2.4 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.4 | 2.2 | 2.4 | 2.8 | 2.2 |

OBJECTIVES:

- To study the particle size distribution of different soil.
- To enhance the knowledge on various index properties of soil.
- To gain knowledge about the compaction characteristics of soil.
- To learn about the shearing properties of soil.
- To study about the bearing capacity of soil.

EXERCISES:**1. DETERMINATION OF INDEX PROPERTIES**

- a. Specific gravity of soil solids
- b. Grain size distribution of cohesionless soil – Sieve analysis
- c. Grain size distribution of cohesive soil- Hydrometer analysis
- d. Liquid limit and Plastic limit tests on cohesive soil
- e. Shrinkage limit and Differential free swell tests for cohesive soil.

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

- a. Field density Test (Sand replacement method)
- b. Determination of moisture – density relationship using standard Proctor Compaction test.
- c. Determination of relative density for the given sample.

3. DETERMINATION OF ENGINEERING PROPERTIES

- a. Constant Head Permeability determination for given sample.
- b. Falling Head Permeability determination for given sample.
- c. One dimensional consolidation test (Demonstration only)
- d. Direct shear test in cohesionless soil
- e. Unconfined compression test in cohesive soil
- f. Laboratory vane shear test in cohesive soil
- g. Tri-axial compression test in cohesionless soil (Demonstration only)

h. California Bearing Ratio Test for the given soil.

TOTAL: 45 PERIODS

OUTCOMES:

1. Students are able to classify the soil based on IS Code.
2. Students are able to conduct tests to determine both the index properties.
3. Students are able to conduct tests on engineering properties of soils.
4. Students are able to conduct tests on characterization of the soil based on their properties.
5. Students are able to conduct field tests on soil.

REFERENCE BOOKS:

1. Soil Engineering Laboratory Instruction Manual, published by engineering College Cooperative Society, Anna University, Chennai, 2010.
2. Lambe T.W., —Soil Testing for EngineersII, John Wiley and Sons, New York, 1951 Digitized 2008.
3. Saibaba Reddy, E.Ramasastri, K. —Measurement of Engineering Properties of Soils New Age International (P) Limited Publishers, New Delhi, 2002.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, and New Delhi.

| CE3468 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|---|-----|----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | 1 | 3 | - | - | - | - | 1 | - | - | 2 | 3 | 1 | 1 | 3 |
| CO2 | 2 | 2 | 3 | 1 | - | 2 | 1 | - | - | - | - | 3 | 2 | 1 | 2 | 2 |
| CO3 | 2 | 1 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 | 2 | 1 | 3 |
| CO4 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 1 | 1 | 2 | 3 | - | 2 | 3 | - | 2 | - | 2 | 3 | 3 | 2 | 3 | 2 |
| Average | 2.0 | 1.2 | 1.8 | 2.4 | 2.0 | 2.0 | 2.0 | - | 1.5 | - | 2.0 | 2.4 | 2.6 | 1.6 | 1.8 | 2.4 |

Restrained structure –Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Analyze the pin-jointed plane and space frames.
2. Analyze the continuous beams and rigid frames by slope deflection method.
3. Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
4. Analyze the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
5. Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXTBOOKS:

1. Bhavikatti, S.S, Structural Analysis, Vol.1,& 2, Vikas Publishing House Pvt.Ltd.New Delhi-4, 2023.
2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
3. Analysis Structures: Strength and behavior by T. S. Thandavamoorthy, Oxford University Press. 2005.
4. Structural analysis Volume I & II by R. Vaidyanathan, P. and Perumal, Laxmi Publications, 2023.
5. Bhavikatti, S.S, "Matrix Method of Structural Analysis", I. K. International Publishing House Pvt.Ltd., New Delhi-4, 2014.

REFERENCE BOOKS:

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2017.

2. Reddy .C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2017.
3. Negi L.S. and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing. Co. Ltd. 2004
4. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt.Ltd. New Delhi-4, 2014.
5. Hibbeler, R.C.,Structural Analysis, VII Edition, Prentice Hall, 2017.

| CE3561 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| Average | 3.0 | 3.0 | 3.0 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 3.0 | 2.0 | 1.0 | 1.2 | 3.0 | 3.0 | 3.0 | 3.0 |

**CE3562 DESIGN OF REINFORCED CEMENT CONCRETE
ELEMENTS**

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

- To introduce students to the fundamental concepts of structural design, focusing on reinforced concrete structures.
- To enable students to understand and apply the principles of limit state design for flexural members, covering analysis and design various beams.
- To equip students with the knowledge and skills required for the limit state design of slabs and staircases for various boundary conditions.
- To equip students with the knowledge of limit state design principles for columns.
- To introduce students to the principles of limit state design for footings.

UNIT - I: METHODS OF DESIGN OF CONCRETE STRUCTURES

9

Objective of structural design - Concept of reinforced concrete structures - Properties of Concrete and Reinforcing Steel - Different grades of concrete and steel used in RCC Load and loading standards as per IS:875 - Concept of Elastic method, ultimate load method and limit state method - Design of beams by working stress method.

UNIT - II: LIMIT STATE DESIGN FOR FLEXURE

9

Analysis and design of singly and doubly reinforced rectangular and flanged beams - Behavior of rectangular RC beams in bond, anchorage, shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

UNIT- III: LIMIT STATE DESIGN OF SLABS AND STAIRCASE

9

Analysis and design of Cantilever - one way - two way - continuous slabs for various boundary conditions. Staircases - Types of Staircases - Design of staircases (ordinary and doglegged)

UNIT - IV: LIMIT STATE DESIGN OF COLUMNS

9

Types of columns – Braced and unbraced columns – Design of short Rectangular

and circular columns for axial, uniaxial and biaxial bending - Design of Slender columns using SP-16.

UNIT - V: LIMIT STATE DESIGN OF FOOTINGS

9

Concept of column footing - Design of wall footing — Design of axially and eccentrically loaded Square, Rectangular and sloped footings – Design of Combined Rectangular and Trapezoidal footing for two columns - Principles of design of mat foundation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

1. Apply the elastic method, ultimate load method, and limit state method to design beams using the working stress method.
2. Design reinforced concrete members for combined bending, shear, and torsion, ensuring structural safety and efficiency.
3. Proficient in the limit state design of slabs and staircases.
4. Differentiate between braced and unbraced columns, design columns based on limit state principles.
5. Design efficient footings applying the principles of limit state design for different loading conditions.

TEXT BOOKS:

1. Krishnaraju.N, “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
2. Varghese, P.C., — Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, 2008.
3. Gambhir. M.L., — Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
4. Subramanian,N., — Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2013.
5. Unnikrishna Pillai, S., Devadas Menon, — Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., 2021.

REFERENCES:

1. IS 456:2000, — Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
2. SP16, IS 456:1978, — Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999
3. Jain, A.K., — “Limit State Design of RC Structures”, Nemchand Publications, Roorkee, 1998.
4. Ramachandra, — Limit state Design of Concrete Structures, Standard Book House, New Delhi
5. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, —Limit State Design of Reinforced Concrete, Laxmi Publication Pvt. Ltd., New Delhi, 2017.

| CE3562 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | - | - | 2 | - | - | 1 | 3 | 1 | 2 | 1 | 1 | 2 | - |
| CO2 | 2 | 2 | - | 2 | - | 2 | - | 2 | 1 | 2 | - | 2 | - | - | 2 | - |
| CO3 | 2 | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | 2 | - | 2 | - | - | 2 | - |
| CO4 | 3 | 2 | 2 | 3 | - | 2 | - | 2 | 2 | 3 | - | 3 | - | 1 | 2 | - |
| CO5 | 2 | 2 | 2 | 2 | - | 2 | 3 | 2 | 2 | 3 | 1 | 3 | 1 | 1 | 2 | - |
| Average | 2.4 | 1.8 | 2.0 | 2.3 | 1.0 | 2.0 | 3.0 | 2.0 | 1.6 | 2.6 | 1.0 | 2.4 | 1.0 | 1.0 | 2.0 | 0.0 |

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| CE3563 | HIGHWAY AND RAILWAY ENGINEERING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To give an overview about the highway engineering with respect to planning and geometric design
- Ability to learn traffic study and traffic operation requirement.
- At the end of the course the students have knowledge of construction and maintenance of highways as per IRC standards.
- To gain the knowledge of geometric design of railways
- To gain the knowledge of Construction techniques and Maintenance of Track laying and Railway stations.

UNIT- I HIGHWAY PLANNING PRINCIPLES, ALIGNMENT AND GEOMETRIC DESIGN 9

Highway Planning Principles: Introduction to transportation, different modes of transportation, classification of roads, network patterns, planning surveys. Highway Alignment: Requirements and factors controlling and Engineering surveys Geometric Design: Cross section Elements, Sight distances, Horizontal alignment and Vertical alignment. Concepts of Highway project preparation

UNIT- II TRAFFIC ENGINEERING PRINCIPLES AND TRAFFIC OPERATIONS 9

Traffic studies on flow, Speed and travel time, Highway capacity and level of service of rural highways and urban roads. Types of intersections, and channelization; Traffic operations: traffic signs, road markings, signals and warrants and Road safety.

UNIT- III PAVEMENT MATERIALS, DESIGN & CONSTRUCTION 9

Experimental characterization of pavement materials; Types of pavement structures, Concepts on Analysis and Design of pavement systems; functions of pavement components, design factors.. Design of flexible and rigid pavement as per IRC methods. Highway Construction: Types of Pavement layers, Construction of Granular, Bituminous and Cement Concrete layers.

UNIT- IV INTRODUCTION, PERMANENT WAY, GEOMETRIC DESIGN 9

Role of Indian Railways in National Development — Railways for Urban Transportation –LRT & MRTS. Permanent Way: Components and their Functions; Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks; Sleepers & Ballast — Functions, Materials, Density; Geometric Design of Railway Tracks: Gradients and Grade Compensation, Speed types, Cant, Negative super elevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

UNIT- V POINTS & CROSSINGS, SIGNALING & INTERLOCKING, STATIONS & YARDS 9

Design of turnouts, Classification of signals, Control systems of train movements, Points and signals interlocking, Types of Stations and Yards, Rolling Stock, Tractive Power, Track Maintenance.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Get knowledge on planning and aligning of highway.
2. Understand the principles of traffic and traffic operation.
3. Gain knowledge on Highway construction materials, properties and testing methods.
4. Understand the methods of route alignment and design elements in Railway Planning and Constructions.
5. Understand the Construction techniques and Maintenance of Track laying and Railway stations.

TEXTBOOKS:

1. Highway Engineering - S.K Khanna, C.E.G. Justo and Veeraragavan, Nem Chand and Bros, Roorkee, India, Tenth edition 2017.
2. Principles and Practices of Highway Engineering - L. R. Kadiyali & N. B Lal, (Khanna Publishers) New Delhi, Ninth Edition, 2017.

3. Railway Engineering - Chandra S. and M.M. Agarwal Oxford University Press, New Delhi, India, Second edition, 2013.
4. Venkatramaiah. C., —Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press (India) Private Limited, Hyderabad, 2015.
5. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013.

REFERENCE BOOKS:

1. Principles of Pavement Design - Yoder, E.J. and M.W. Witczak, (John Wiley and Sons), Second Edition 2012.
2. Relevant MORTH, and IRC codes and guidelines.
3. Pavement Analysis and Design - Y.H. Huang, (Pearson Prentice Hall), New Jersey, USA, 2008.
4. Railway Engineering- Saxena, S.C. and S.P. Arora, Dhanpat Rai and Sons, New Delhi, India, 1997.
5. Railway Track Engineering - J.S. Mundrey, Tata McGraw-Hill Education Private Limited, New Delhi, Fourth Edition, 2010.

| CE3563 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 |
| CO2 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | 1 |
| CO3 | 3 | 1 | 2 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 |
| CO4 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| CO5 | 3 | 1 | 2 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 |
| Average | 3.0 | 1.0 | 1.4 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 3.0 | 1.0 | 1.0 | 1.2 | 3.0 | 1.0 | 1.0 | 1.6 |

COURSE OBJECTIVES:

- To make the students to understand the concepts, components and source of remote sensing.
- To understand about atmospheric profile and its characteristics.
- To gain knowledge about different types of remote sensing platforms and sensors.
- Understand the fundamentals of GIS, maps, data structures and analysis of data.
- To understand the applications of remote sensing in Civil Engineering.

UNIT - I: REMOTE SENSING AND ELECTRO MAGNETIC RADIATION 9

Definition – Components of Remote Sensing – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Active and Passive Remote Sensing – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra-Red (IR), Near IR, Middle IR , Thermal IR and Microwave – Black Body Radiation. Wave theory - Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, and Kirchhoff's law.

UNIT- II: EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT - III: ORBITS AND PLATFORMS 9

Motions of planets and satellites — Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types — Orbital perturbations and maneuvers — Types of

remote sensing platforms - Ground based, Airborne platforms and Space borne platforms — Classification of satellites — Sun synchronous and Geosynchronous satellites — Legrange Orbit.

UNIT - IV: GEOGRAPHIC INFORMATION SYSTEM

9

GIS – Components of GIS – Hardware, Software and Organizational Context – Data — Spatial and Non-Spatial — Maps — Types of Maps — Projection — Types of Projection - Data Input — Digitizer, Scanner — Editing — Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

UNIT - V: DATA INTERPRETATION AND CIVIL ENGINEERING APPLICATIONS 9

Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing — Application of Remote Sensing and GIS – Urban Applications - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS — Water resources — Urban Analysis — Watershed Management – Resources Information Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

1. Understand the concepts and laws related to remote sensing.
2. Understand the interaction of electromagnetic radiation with atmosphere and earth material.
3. Acquire knowledge about satellite orbits and different types of satellites.
4. Understand about GIS and maps.
5. Gain knowledge about the concepts of interpretation of satellite imagery and civil engineering applications

TEXT BOOKS:

1. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2 nd edition. BS Publications, Hyderabad, 2001.

2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Universities Press (India) Private limited, Hyderabad, 2018.
3. M.G. Srinivas(Edited by), Remote Sensing Applications, Narosa Publishing House, 2001.
4. Lillesand,T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition., John Willey and Sons Asia Pvt. Ltd., New Delhi, 2004.
5. Paul A. Longley, Michael Goodchild, David J. Maguire, and David W. Rhind, Wiley, 4th Edition, 2015.

REFERENCES:

1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995.
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.
4. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011.
5. Lillesand T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 2015.

| CE3564 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | 1 | 2 | - | - | - | 3 | - | 2 | 2 | 2 | 1 | 1 |
| CO2 | 1 | 2 | - | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 3 | 1 | 1 | 1 |
| CO3 | 1 | 2 | 2 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 2 | 2 | 1 | 1 |
| CO4 | 1 | 2 | 2 | 3 | 2 | 2 | - | - | - | 3 | - | 3 | 3 | 2 | 1 | 2 |
| CO5 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | - | - | 3 | - | 3 | 3 | 1 | 1 | 2 |
| Average | 1.0 | 2.0 | 2.0 | 2.3 | 1.6 | 2.0 | 3.0 | 0.0 | 0.0 | 2.6 | 0.0 | 2.4 | 2.6 | 1.6 | 1.0 | 1.4 |

OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT- I ENVIRONMENT AND BIODIVERSITY**6**

Definition, scope and importance of environment – need for public awareness. Ecosystem and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity –endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ and Wild Life Act.

UNIT- II ENVIRONMENTAL POLLUTION**6**

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHSMS). Environmental protection, Environmental protection acts, Environmental policies and various Environmental Programmes conducted around the world.

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
2. Daniel B. Botkin and Edward A. Keller "Environmental Science: Earth as a Living Planet", 8th Edition" Wiley India Publisher ,2024.
3. Deeksha Dave, S.S. Katewa, Chandana Mohanty, Sarbari Acharya, "Textbook of Environmental Studies (3rd Edition), Cengage India Publisher, 2024.
4. P.N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, "Environmental Science", 4th Edition, Pearson Education Publisher,2023.
5. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 3rd edition, Pearson Education, 2023.
6. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall,2011.
7. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering Applications in Sustainable Design and Development, Cengage learning, 2015.

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

| CE3531 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | - | - | - | 2 | 3 | - | - | - | - | 2 | - | - | - | - |
| CO2 | 3 | 2 | - | - | - | 3 | 3 | - | - | - | - | 2 | - | - | - | - |
| CO3 | 3 | - | 1 | - | - | 2 | 2 | - | - | - | - | 2 | - | - | - | - |
| CO4 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | - | - | - | - |
| CO5 | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 1 | - | - | - | - |
| Average | 2.8 | 1.8 | 1.0 | 1.0 | 0.0 | 2.2 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 |

GE3551

NCC CREDIT COURSE LEVEL - II

L T P C

(Common to Army, Navy & Air)

3* 0 0 3*

OBJECTIVES:

- To know the basic principles of adventure program and creating awareness for social.
- To improve the cadet's knowledge in firefighting and their health's.
- To create an interest in handling the weapons and read the map.
- To know the handling the situation on ground in army battle.
- To know about anchors, ropes and communication procedure in the Naval wing.

UNIT- I ADVENTURE AND SOCIAL AWARENESS PROGRAM 9

Parasailing, Slithering, Rock Climbing, Cycling and Trekking, Obstacle training. Basic Social Service and its needs, Rural Development Programmes. NGOs: Role and Contribution, Responsibility of Swachh Bharat Abhiyanm, Contribution of Youth towards Social Welfare, Social Security Schemes, Social Evils viz Dowry/ Female Foeticide/ Child abuse and trafficking etc. Protection of Children.

UNIT- II FIRE FIGHTING AND HEALTH AND HYGIENE 9

Types of fire, Triangle of fire- Types of fire-fighting, water markings in the ship, NBCD organization and structure, Damage control, Aims of First Aid, Principle of First Aid, Motto of First Aid, List of items in First aid Box, Types of Bandages, Types of Fracture, Dislocation, Types of Wounds, Burns and Scalds, Sprain, Strain, Asphyxia, Drowning, Poison, Shock, Snake bite, Sun and Heat Stroke, Insect bite, Dog bite, Hanging, Artificial Respiration, Artificial respiration, carriage of sick and wounded.

UNIT- III WEAPON TRAINING AND MAP READING 9

Characteristics of a rifle/rifle ammunition and its fire power, Stripping, assembling, care and cleaning and sight setting of .22 rifle, Loading, cocking and unloading, The lying posn, holding and Aiming – 1, Range procedure and safety precautions, Theory of group and snap shooting, Introduction of types of Maps and conventional signs,

TEXTBOOKS:

1. E- Book , NCC Red Book, Director General NCC, Ministry of Defence, RK Puram New Delhi (link: [red book 26-5-2017.pmd \(s3waas.gov.in\)](#))
2. Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, by RPH Editorial Board, Kindle Edition.

CE3565

**BUILDING DRAWING AND DETAILING
LABORATORY**

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

OBJECTIVES:

- To learn plan, elevation and sectional view of the load bearing and framed buildings
- To learn the structural detailing of RCC elements
- To learn the structural detailing of RCC water tanks, footings and retaining walls
- To learn the structural detailing of steel structures
- To gain the knowledge of Draft the structural detailing of Industrial structures

LIST OF EXPERIMENTS:

1. Principles of planning and orientation
2. Buildings with load bearing walls and RCC roof (Plan , section , elevation)
3. Buildings with sloping roof
4. Buildings with Framed structures.
5. Building information modeling.
6. Reinforcement details of Staircase (ordinary and doglegged)
7. Reinforcement details of RCC structural elements (slab, beam and column)
8. Reinforcement details of footings (Isolated, stepped, combined footing)

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able:

1. Draft the plan, elevation and sectional view of the load bearing and framed buildings
2. Draw the structural detailing of RCC elements
3. Draw the structural detailing of RCC water tanks, footings and retaining walls
4. Draw the structural detailing of steel structures
5. Draft the structural detailing of Industrial structures

REFERENCES:

1. V.B.Sikka, "A course in Civil Engineering Drawing" S.K.Kataria & Sons Publishers, Seventh Edition, 2015.
2. D.N.Ghose, "Civil Engineering Drawing and Design" CBS Publishers & Distributors Pvt.Ltd., 2nd Edition, 2010.
3. National Building Code of India 2016 (NBC 2016).
4. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
5. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016.

| CE3565 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 2 | - | - | 1 | - | - | - | 1 | 3 | 2 | | 2 |
| CO2 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | 2 | - | 2 | 3 | 2 | 2 | 1 |
| CO3 | 3 | 2 | - | - | 2 | 3 | - | 2 | 3 | 2 | - | 2 | 3 | 2 | 2 | 1 |
| CO4 | 3 | 2 | - | 2 | 2 | 3 | - | 1 | 3 | 2 | - | 2 | 3 | 2 | 2 | - |
| CO5 | 3 | 2 | - | 2 | 2 | 3 | - | 2 | 3 | 2 | - | 2 | 3 | 2 | 2 | - |
| Average | 3.0 | 2.0 | 0.0 | 2.0 | 2.0 | 3.0 | 0.0 | 1.6 | 3.0 | 2.0 | 0.0 | 1.8 | 3.0 | 2.0 | 2.0 | 1.3 |

OBJECTIVES:

- To learn the principles and procedures of testing of coarse aggregates
- To study about various test on bitumen.
- To enhance the knowledge on properties of fresh concrete.
- To gain knowledge about the strength properties of hardened concrete.
- To learn about the test on bituminous mixes.

LIST OF EXPERIMENTS:**1. TESTS ON AGGREGATES**

- a) Los Angeles Abrasion Test on aggregates

2. TESTS ON BITUMEN

- a) Specific Gravity of Bitumen
- b) Penetration Test of Bitumen
- c) Viscosity Test of Bitumen
- d) Softening Point Test of Bitumen
- e) Ductility Test of Bitumen

3. TESTS ON CONCRETE

- a) Test for Slump
- b) Test for Compaction factor
- c) Flow table test of concrete
- d) Vee bee Test of concrete
- e) Test for Compressive strength - Cube & Cylinder
- f) Test for Flexural strength of concrete

4. TESTS ON BITUMINOUS MIXES

- a) Stripping Test on bituminous mixes
- b) Determination of Binder Content on bituminous mixes
- c) Marshall Stability and Flow Values on bituminous mixes (Demonstration)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able:

1. To know the techniques to characterize various pavement materials through relevant tests.
2. To conduct tests on aggregates.
3. To conduct tests on bitumen.
4. To conduct tests on concrete.
5. To classify various mix of bitumen.

TEXT BOOKS:

1. Highway Materials and Pavement Testing, NemChand and Bros., Roorkee, Revised Fifth Edition, 2013.
2. Methods for testing tar and bituminous materials, IS 1201–1978 to IS 1220–1978, Bureau of Indian Standards.
3. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.
5. N.L.Arora, A Textbook of Transportation Engineering, New India Publication, 1997.

| Sl.No. | Description of Equipment | Quantity |
|---------------|--|-----------------|
| 1. | Concrete cube moulds | 6 |
| 2. | Concrete cylinder moulds | 6 |
| 3. | Concrete Prism moulds | 3 |
| 4. | IS Sieves 40 mm, 31.5 mm, 25 mm, 20mm, 16mm, 12.5 mm, 10mm, 6.3 mm | 2 |
| 5. | Concrete Mixer machine | 1 |
| 6. | Slump cone | 3 |
| 7. | Flow table | 1 |
| 8. | Vibrator | 1 |
| 9. | Trowels and planers | 1 |
| 10. | UTM - 400 kN capacity | 1 |

| | | |
|-----|--|---|
| 11. | Vee Bee Consistometer | 1 |
| 12. | Pycnometer | 2 |
| 13. | Bitumen Extractor | 1 |
| 14. | Los - Angeles abrasion testing machine | 1 |
| 15. | Marshall Stability Apparatus | 1 |
| 16. | Compression testing machine | 1 |
| 17. | Flexure testing machine | 1 |
| 18. | Ductility Testing Machine | 1 |
| 19. | IS sieves 12.5 mm, 10 mm and 2.36 mm | 2 |
| 20. | Oven | 1 |
| 21. | Tar Viscometer | 1 |
| 22. | Ring and Ball apparatus | 1 |
| 23. | Standard Penetrometer (Electrical) | 1 |

| CE3566 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | - | - | - | 1 | 3 | - | 1 | - | 1 | 1 | - | - | - |
| CO2 | 1 | - | 3 | 2 | - | - | - | - | - | 1 | - | 2 | - | 1 | - | - |
| CO3 | 1 | 2 | 3 | - | - | - | - | 3 | - | 2 | - | - | - | 2 | 1 | - |
| CO4 | 1 | - | 3 | - | - | 2 | - | 3 | 3 | 3 | 1 | - | - | - | - | 1 |
| CO5 | - | 1 | 2 | 1 | 2 | 3 | - | - | 1 | - | - | 1 | - | 1 | - | 2 |
| Average | 1.5 | 2.0 | 2.6 | 1.5 | 2.0 | 2.5 | 1.0 | 3.0 | 2.0 | 1.8 | 1.0 | 1.3 | 1.0 | 1.3 | 1.0 | 1.5 |

| | | | | | |
|---------------|---|----------|----------|----------|----------|
| CE3541 | SURVEY CAMP | L | T | P | C |
| | (During IV semester Summer Vacation 2 weeks) | 0 | 0 | 0 | 1 |

OBJECTIVES:

- The objective of the survey camp is to enable the students to do the experiments in the various types of surveying to provide better knowledge and skill in facing field work and working out of contour map and profile levelling.
- Acquire practical knowledge on handling survey instruments like Theodolite – to measure horizontal, vertical angles, calculation of area and elevation of ground surface.
- Acquire adequate knowledge to carryout Triangulation, understand the importance of Triangulation and their applications in surveying.
- Tachometry - to identify the elevation and horizontal distance between instrument and object.
- Acquire field knowledge on handling survey instruments like Total station including general field marking for various engineering projects.

Course content:

Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Triangulation and Trilateration- using theodolite.
2. Traverse - using Total station.
3. Contouring
 - (i) Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line.
 - (ii) Block Level/ by squares of size at least 100 Meter x 100 Meter at least 20 Meter interval.
 - (iii). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M.

4. Offset of Buildings and Plotting the Location.
 5. Sun observation to determine azimuth (guidelines to be given to the students).
 6. Use of GPS to determine latitude and longitude and locate the survey camp location.
 7. Traversing using GPS.
 8. Curve setting by deflection angle.
- Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

| CE3541 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | - | - | - | - | - | 1 | - | - | 2 | 2 | 1 | - | 1 |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 | 1 | - |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | - | - | - | 2 | 2 | - | 1 |
| CO4 | 3 | 1 | 1 | - | - | - | - | - | 2 | - | - | 2 | 3 | - | 1 | 2 |
| CO5 | 3 | 1 | 1 | 2 | 3 | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 |
| Average | 3.0 | 1.8 | 1.5 | 2.0 | 3.0 | 0.0 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 | 2.0 | 2.4 | 1.8 | 1.3 | 1.3 |

OBJECTIVES:

- To learn the method of drawing influence lines and its uses in various applications like determinate beams, bridges
- To learn the method of drawing influence lines and its uses in various applications like indeterminate beams, bridges
- To understand the concept of Analyze three hinged, two hinged and fixed arches
- To understand the concept of Analyze the suspension bridges with stiffening girders
- To learn Plastic analysis of indeterminate beams and rigid frames

UNIT-I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9

Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influence lines for member forces in pin jointed plane frames.

UNIT-II INFLUENCE LINES FOR INDETERMINATE BEAMS 9

Muller Breslau's principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.

UNIT-III ARCHES 9

. Arches - Eddy's theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches - Parabolic and circular arches - influence lines, rib shortening

UNIT-IV SUSPENSION CABLES AND SPACE TRUSSES 9

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to

analysis of space trusses using method of tension coefficients.

UNIT-V PLASTIC ANALYSIS

9

Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods –Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Draw influence lines for statically determinate structures and calculate critical stress resultants.
2. Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
3. Analyze three hinged, two hinged and fixed arches.
4. Analyze the suspension bridges with stiffening girders
5. Understand the concept of Plastic analysis and the method of analyzing beams and rigid frames.

TEXTBOOKS:

1. Bhavikatti, S.S, Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt.Ltd.New Delhi-4, 2014.
2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2014.
3. Structural analysis Volume I & II by R. Vaidyanathan, P. and Perumal, Laxmi Publications, 2023.
4. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2004.
5. Analysis Structures: Strength and behavior by T. S. Thandavamoorthy, Oxford University Press. 2005.

REFERENCE BOOKS:

1. Negi.L.S and Jangid R.S., Structural Analysis, Tata McGraw-Hill Publishers, 2019.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., Third Edition, 2010.
3. Gambhir.M.L. Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2015..
4. Vazrani.V.N and Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.
5. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2023.

| CE3661 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| Average | 3.0 | 3.0 | 3.0 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 3.0 | 2.0 | 1.0 | 1.2 | 3.0 | 3.0 | 3.0 | 3.0 |

OBJECTIVES:

- Apply the IS (800-2007) code practice for the design of steel structural elements, analyses and design tension members.
- To understand the basic concepts of limit state design of structural members.
- Design bolted and welded connections.
- Understand the concept of lateral buckling and design various elements like gantry girder, plate girder, beam- column.
- Learn the design of connections, roof truss and purlin design.

UNIT- I: INTRODUCTION**9**

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures–Basic concepts of connection-Bolted connection: Types of bolts-modes of failures; Joints subjected to direct and eccentric load-Welded connection: Types and strength of welds Butt and fillet welds -Joints subjected to direct load and eccentric load.

UNIT- II: TENSION MEMBERS**9**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT- III: COMPRESSION MEMBERS**9**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns.

UNIT- IV: BEAMS**9**

Design of laterally supported and unsupported beams - Design of built-up beams - Design of welded plate girders.

UNIT- V: INDUSTRIAL STRUCTURES

9

Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design, Design of joints and end bearings–Design principles of gantry girder - Introduction to pre-engineered buildings.

TOTAL: 45 PERIODS

OUTCOMES:

1. Able to understand about the various types of connections.
2. Able to design tension splices and braced members.
3. Understand about basic elements of steel structures such as Tension and compression members.
4. Able to design the beams and beam-column .
5. Able to design the Industrial structures.

TEXT BOOKS:

1. Gambhir M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2015
2. Shiyekar M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2023.
3. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi, 2015.
4. L.S.Negi., "Design of steel structures", Tata McGraw Hill Publishing Company, 1997.
5. R.C.Hibbeler., " Design of Steel Structures " Pearson Publishing, 2015.

REFERENCE BOOKS:

1. Narayanan.R.et.al, "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
2. Duggal S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2019.
3. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2014.

4. Shah.V.L and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2016.
5. IS800:2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007.

| CE3662 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | 3 | 3 | - | 1 | - | 1 | 2 | - | 2 | 3 | 1 | 2 | 3 |
| CO2 | 2 | 3 | 3 | 1 | 3 | 2 | - | 2 | 2 | - | - | 2 | 3 | 3 | 1 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 1 | - | 2 | - | - | 2 | - | 2 | 3 | 3 | 1 | 3 |
| CO4 | 2 | 3 | 2 | 3 | 3 | 2 | - | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | - | - | 2 | 2 | - | - | 3 | 3 | 3 | 2 | 3 |
| Average | 2.0 | 2.8 | 2.5 | 2.2 | 2.6 | 2.0 | 1.5 | 2.0 | 1.8 | 2.0 | 0.0 | 2.2 | 3.0 | 2.6 | 1.6 | 2.8 |

| | | | | | |
|---------------|-------------------------------------|----------|----------|----------|----------|
| CE3663 | WATER SUPPLY AND WASTE WATER | L | T | P | C |
| | ENGINEERING | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To know about the objectives of various components and design of water supply scheme.
- To equip the students with the principles and design of water treatment units and distribution system.
- To understand about water storage and distribution system
- Ability to gain the knowledge of planning and design of sewerage system.
- To gain the knowledge of treatment techniques of waste water and disposal of waste water system.

UNIT- I WATER SUPPLY-SOURCE AND CHARACTERISTICS 9

Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake Structures ,Rain Water Harvesting.

UNIT- II DESIGN PRINCIPLES OF WATER TREATMENT 9

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 - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operation and Maintenance aspects

UNIT- III WATER STORAGE AND DISTRIBUTION 9

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House

service connections. Intake of water: Pumping and gravity schemes.

UNIT- IV PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage

UNIT- V SEWAGE TREATMENT AND DISPOSAL 9

objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge. Recycling of water using Reverse Osmosis process.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission
2. Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations
3. Understand the process of conventional treatment and design of water and wastewater treatment system and gain knowledge of selection of treatment process and biological treatment process
4. Design and evaluate water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods.
5. Understand and design the various advanced treatment system and knowledge

about the recent advances in water and wastewater treatment process and reuse of sewage.

TEXTBOOKS:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2024.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2021.
3. Garg, S.K., Environmental Engineering Vol.II, Khanna Publishers, New Delhi, 202.
4. Duggal K.N., "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.
5. Punmia, B.C., Jain, A.K., and Jain.A.K., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

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1. Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2016.
2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2024.
3. Syed R. Qasimand Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
4. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2014.
5. Syed R.Qasim "Waste water Treatment Plants", CRCPress, WashingtonD.C., 2009
6. Gray N.F, "Water Technology", Elsevier India Pvt.Ltd. New Delhi, 2010.

| CE3663 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 3 | - | 2 | | | | 1 | 1 | | | | 3 | | | 2 |
| CO2 | | | | | | | | 1 | 1 | | | | 3 | | | 2 |
| CO3 | 3 | 3 | 3 | | 2 | 3 | 3 | 2 | 3 | | 2 | | 3 | | 2 | |
| CO4 | 3 | 3 | 3 | | 2 | 3 | 3 | 2 | 3 | | 2 | | 3 | | 2 | |
| CO5 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | |
| Average | 2.8 | 3.0 | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 1.6 | 2.2 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 2.0 | 2.0 |

| | | | | | |
|---------------|-------------------------------------|----------|----------|----------|----------|
| CE3664 | WATER SUPPLY AND WASTE WATER | L | T | P | C |
| | ANALYSIS LABORATORY | 0 | 0 | 4 | 2 |

OBJECTIVES:

- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

LIST OF EXPERIMENTS: ANALYSIS OF WATER SAMPLE

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity, TDS, pH and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water.
6. Determination of Optimum Coagulant Dosage by Jar test apparatus.
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water.
8. Determination of Alkanity and Acidity.

ANALYSIS OF WASTEWATER SAMPLE

9. Estimation of suspended, volatile and fixed solids
10. Determination of Sludge Volume Index in waste water
11. Determination of Dissolved Oxygen
12. Estimation of B.O.D.
13. Estimation of C.O.D.
14. Determination of TKN and Ammonia Nitrogen in wastewater
15. 14. Determination of total and faecal coliform (Demonstration only)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able:

1. Calibrate and standardize the equipment
2. Collect proper sample for analysis
3. To know the sample preservation methods
4. To perform field oriented testing of water, wastewater
5. To perform coliform analysis

REFERENCES:

1. APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed. Washington, 2017.
2. "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist, H. – Second Edition, VCH, Germany, 3rd Edition, 1999.
3. "Methods of air sampling & analysis", James P.Lodge Jr (Editor) 3rd Edition, Lewis publishers, Inc., USA, 2020.
4. Metcalf & Edd., "Wastewater Engineering: Treatment and Resource Recovery" McGraw-Hill Education, 2014.
5. Manual of Water Supply and Treatment., "Central Public Health and Environmental Engineering Organization (CPHEEO)", Ministry of Urban Development, Government of India, 2024.

| CE3664 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | 2 | 2 | 1 |
| CO3 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 |
| CO5 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 |
| Average | 2.0 | 1.8 | 1.8 | 1.8 | 2.0 | 1.8 | 2.0 | 2.4 | 1.8 | 1.6 | 2.0 | 2.6 | 2.0 | 2.0 | 2.0 | 1.6 |

| | | | | | |
|---------------|--|----------|----------|----------|------------|
| CE3665 | IRRIGATION DESIGN AND ENVIRONMENTAL | L | T | P | C |
| | DRAWING LABORATORY | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To learn the knowledge of design and drawing of tank components in details showing plan, elevation and cross section.
- To gain the knowledge of design and drawing of cross drainage works in details showing plan, elevation and cross section.
- To understand the knowledge of design and drawing of canal regulation structures in details showing plan, elevation and cross section.
- To learn the knowledge of design and drawing of water supply and treatment components.
- To learn the knowledge of design and drawing of sewage treatment and disposal components.

PART A: IRRIGATION ENGINEERING

1. TANK COMPONENTS 5

Fundamentals of design - Tank surplus weir – Tank sluice with tower head - Drawings showing foundation details, plan and elevation

2. CROSS DRAINAGE WORKS 5

General design principles - Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) – Drawing showing plan, elevation and foundation details.

3. CANAL REGULATION STRUCTURES 11

General Principles - Direct Sluice - Canal regulator - Drawing showing detailed plan, elevation and foundation details.

PART B: ENVIRONMENTAL ENGINEERING

4. WATER SUPPLY AND TREATMENT 12

Design and Drawing of flash mixer, flocculator, clarifier – Rapid sand filter – Service

reservoirs Pumping station.

5. SEWAGE TREATMENT & DISPOSAL

12

Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process – Aeration tank – Trickling filter – Sludge digester – Sludge drying beds – Septic tanks and disposal arrangements.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Design and draw tank components in details showing plan, elevation and cross section.
2. Design and draw cross drainage works in details showing plan, elevation and cross section.
3. Design and draw canal regulation structures in details showing plan, elevation and cross section.
4. Design and draw water supply and treatment components.
5. Design and draw sewage treatment and disposal components.

TEXTBOOKS:

1. Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2004.
2. Garg, S.K., "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 2023.
3. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2024.
4. Manual on "Sewerage and Sewage Treatment Systems- Part A, B and C" CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
5. Qasim, S. R. "Wastewater Treatment Plants, Planning, Design & Operation", CRC Press, New York, 2018.

REFERENCE BOOKS:

1. Mohanakrishnan. A, “A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu”, Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2. Raghunath, H.M. “Irrigation Engineering”, Wiley India Pvt. Ltd., New Delhi, 2011.
3. Sharma R.K., “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., New Delhi, 2017.
4. Peary, H.S., ROWE, D.R., Tchobanoglous, G., “Environmental Engineering”, McGraw- Hill Book Co., New Delhi, 1995.
5. Metcalf and Eddy, “Wastewater Engineering, Treatment and Reuse”, Tata McGraw Hill, New Delhi, 2014.
6. Qasim, S.R., Motley, E.M and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2009.

| CE3665 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 3 | 2 | | 2 | 1 | 1 | 1 | 1 | | 2 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 2 | | 1 | 1 | 1 | 1 | 1 | | 2 | 3 | 1 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 2 | | 2 | 1 | 2 | 1 | 1 | | 1 | 3 | 2 | 2 | 1 |
| CO4 | 3 | 2 | 3 | 2 | | 2 | 1 | 1 | 1 | 1 | | 2 | 3 | 1 | 1 | 1 |
| CO5 | 3 | 2 | 3 | 2 | | 2 | 1 | 1 | 1 | 1 | | 2 | 3 | 2 | 2 | 1 |
| Average | 3.0 | 2.0 | 3.0 | 2.0 | 0.0 | 1.8 | 1.0 | 1.2 | 1.0 | 1.0 | 0.0 | 1.8 | 3.0 | 1.6 | 2.0 | 1.6 |

| | | | | | |
|---------------|-----------------------------------|----------|----------|----------|----------|
| EN3649 | PROFESSIONAL COMMUNICATION | L | T | P | C |
| | LABORATORY | 0 | 0 | 2 | 1 |

OBJECTIVES:

- Enhance the Employability and Career Skills of students.
- Orient the students towards grooming as a professional.
- To learn how to speak in Group Discussions
- Make them employable Graduates and help them attend interviews successfully.
- Develop their confidence and help them express views clearly

UNIT- I **6**

English for competitive exams — general awareness of current affairs – multiple choice – cloze – vocabulary structure.

UNIT- II **6**

Introduction to soft skills - Interpersonal communication - Introducing oneself to the audience – answering questions – writing a message – memo –mail – asking for comments – giving information – agreeing to requests – apologizing – Complaining – Business proposal – short report – summarizing.

UNIT- III **6**

Introduction to Group Discussion— participating in Group Discussions – questioning and clarifying – GD strategies –monologues – dialogues.

UNIT- IV **6**

Interview etiquette – Portfolio development - attending job interviews – FAQs related to job interviews - Interview types – expressing opinions – present circumstances - past experiences – future plans.

UNIT- V **6**

Recognizing differences between groups and teams - networking professionally- respecting social protocols- understanding career management- developing a long-

term career plan- making career changes. – organizing a larger unit of discourse – expressing and justifying opinions – negotiating – collaborating – disagreeing – speculating – decision taking.

TOTAL : 30 PERIODS

The lab course is offered as an **Employability Enhancement Course**

The course is offered as a **one credit** paper with an End Semester Examination.

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Make effective presentations and participate confidently in Group Discussions
2. Attend job interviews and interacting in different situations.
3. Able to write business reports, proposals and related correspondence.
4. Develop adequate Soft Skills required for the workplace

REFERENCE BOOKS:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2020
2. Interact English Lab Manual for Undergraduate Students, Orient Blackswan: Hyderabad, 2016.
3. E.Suresh Kumar Communication for Professional Success. Orient Blackswan: Hyderabad, 2019
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharan. Soft Skills. MJP Publishers: Chennai, 2010.
6. Successful Presentations: DVD and Student's Book. A video series teaching business communication skills for adult professionals by John Huges and Andrew Mallett- OUP 2012.
7. Goodheart-Willcox, "Professional Communication", First Edition, 2017. Online test book
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 Edition, 2015

9. English for success in Competitive exams. Philip Sunil Solomon – OUP 2015.

| EN3649 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | 1 | - | 1 | - | - | - | 2 | - | 1 | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - | - | -- |
| CO3 | - | - | - | - | 1 | - | - | - | - | 2 | - | 1 | - | - | - | - |
| CO4 | - | 1 | - | - | - | - | - | - | - | 2 | - | 1 | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - | - | - |
| Average | 1 | 1 | - | 1 | 1 | 1 | - | - | - | 2 | - | 1 | - | - | - | - |

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| CE3761 | ESTIMATION, COSTING AND VALUATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To provide the student with the ability to estimate the quantities of item of works involved in buildings.
- To equip the students to estimate the quantities of items of work in water supply and sanitary works, road works and irrigation works.
- To provide the student with the ability to prepare tender and contract.
- To equip the student with the ability to do rate analysis and valuation of properties.
- To gain the knowledge of preparation of reports for estimation of various items.

UNIT- I ESTIMATE OF BUILDINGS 9

Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting, Estimate of joineries for paneled and glazed doors, windows, ventilators, handrails etc.

UNIT- II ESTIMATE OF OTHER STRUCTURES 9

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line– sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon, fall.

UNIT- III RATE ANALYSIS, SPECIFICATION AND TENDERS 9

Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour –Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works – Cost Estimates Data – Specifications –

3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 2015
4. .R.P. Rastogi, 'Standard method of measurement of building works', 2015.
5. S.C. Rangwala, 'A Textbook Of Estimating And Costing, 2018.

REFERENCE BOOKS:

1. PWD Data Book.
2. Tamilnadu Transparencies in Tender Act, 1998
3. Arbitration and Conciliation Act, 2021
4. Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April 1996.

| CE3761 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | 2 | 3 | - | 1 | 3 | - | 3 | 2 |
| CO2 | 3 | 2 | - | 1 | 1 | - | - | - | - | - | - | - | - | 2 | - | 1 |
| CO3 | 2 | - | - | - | 2 | 2 | - | 1 | - | - | - | 3 | - | 2 | - | - |
| CO4 | 3 | - | - | - | 2 | 2 | - | - | - | - | 2 | - | 3 | - | 3 | - |
| CO5 | 2 | - | - | - | - | - | 2 | - | - | - | - | - | - | 1 | - | - |
| Average | 2.6 | 2.0 | 2.0 | 1.0 | 1.7 | 2.0 | 2.0 | 1.0 | 2.0 | 3.0 | 2.0 | 2.0 | 3.0 | 1.7 | 3.0 | 1.5 |

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| CE3762 | DYNAMICS AND EARTHQUAKE RESISTANT | L | T | P | C |
| | STRUCTURES | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To gain knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system.
- To develop the equations of motion for MDOF system and to evaluate the natural frequencies and mode shapes.
- To gain knowledge about elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
- To identify various causes and effects of earthquakes on structures due to past earthquakes.
- To analyze the structures subjected to dynamic loading and to design for seismic loading as per codal provisions.

UNIT- I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF system – D’Alembert’s Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Transmissibility - Response to harmonic forces and periodic forces.

UNIT- II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multi degree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT- III INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seism tectonics – Seismic Instrumentation –

Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT- IV EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures – Behaviour of RCC, Steel Structures under earthquake loading – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT- V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Causes of damage – Planning considerations/Architectural concept (IS 4326–1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993)

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Student will develop knowledge in the simulation and mathematical model development.
- Students will be trained to identify, formulate and solve complicated problem.
- Students will be able to understand the role of natural calamity in the damage of structures.
- Students will be able to develop the skill to analyse data and to apply the same in the practical problems.
- Students will be able to apply the developed methodologies for the safe and stable design of structures.

TEXTBOOKS:

1. Mario Paz, Young Hoon Kim, “Structural Dynamics – Theory and Computations”, Sixth Edition, Springer, 2019.

2. Ashok k. Jain, “Dynamics Of Structures With Earthquake Engineering” (2nd edition), 2023
3. Henry R. Busby & George H. Staab, “Structural Dynamics: Concepts and Applications (1st Edition)”, 2017
4. Hector Estrada & Luke S. Lee, “Essentials of Structural Dynamics (1st Edition), 2022.

REFERENCE BOOKS:

1. Anil K Chopra, “Dynamics of structures –Theory and applications to Earthquake Engineering”, Prentice Hall Inc., 2007.
2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, “Elements of Earthquake Engineering”, South Asia Publishers, 1994.
3. Moorthy.C.V.R, “Earthquake Tips”, NICEE, IIT Kanpur, 2002.
4. IS13920-1993 Ductile detailing of reinforced concrete structures subjected to seismic forces Code of practice.
5. IS 1893 part 1 2002 Indian standard criteria for earthquake resistant design of structures
6. IS4326-1993 Earthquake Resistant Design and Construction of Buildings-- Code of Practice (Second Revision)

| CE3762 | PO | | | | | | | | | | | | PSO | | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | - | - | - | |
| CO2 | 1 | 2 | 2 | - | 1 | - | - | 1 | - | 2 | 1 | - | - | 1 | - | - | |
| CO3 | 1 | 1 | 2 | - | 1 | - | - | - | - | 2 | 1 | - | - | 1 | 2 | 1 | |
| CO4 | - | 3 | 3 | - | - | 2 | 1 | - | 1 | 1 | - | 1 | - | - | 1 | - | |
| CO5 | 1 | - | - | 2 | - | - | - | 1 | - | - | - | - | 1 | - | 3 | 2 | |
| Average | 1.0 | 2.0 | 2.3 | 2.0 | 1.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.7 | 1.0 | 1.0 | 1.5 | 1.0 | 2.0 | 1.5 |

UNIT- V ETHICS IN PROFESSION

6

Professional Integrity, Respect & Equality, Privacy, Positive co-operation, Respecting the competence of other professions. - Business ethics - Environmental ethics - Internet ethics - Engineers as expert witnesses and advisors.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will be able to understand the significance of value inputs in a classroom and start applying them in their life and profession.
2. Students will be able to understand the need, basic guidelines, content and process of value education.
3. Students will be able to the role of a human being in ensuring harmony in society and nature.
4. Students will be able to understand social ethics.
5. Students will be able to Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

REFERENCE BOOKS:

1. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill - 2003.
3. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books First Edition 2009.
4. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Professional Ethics and Human Values”, Prentice Hall of India, New Delhi, 2013.
5. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York, 3rd edition (2017).
6. R. Subramanian, ‘Professional Ethics’ Oxford University Press, 2nd Edition 2017

7. R. S. Nagarazan, 'A Textbook on Professional Ethics and Human Values' New Age International Publishers, 2015.
8. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.
9. Langford, Duncan (EDT): Internet Ethics, London, Macmillan Press Ltd., 2000.
10. Erwann, M. David, Michele S. Shauf, Computers, Ethics and Society, Oxford University Press, 2003.
11. Suresh Jayshree, 2003, Human Values and Professional Ethics, S. Chand Publishing, Third Revised Edition.

| BA3711 | PO | | | | | | | | | | | | PSO | | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | | | | | | | 1 | | | | | | | | | | |
| CO2 | | | 1 | | | | | | | | | | | | | | |
| CO3 | | | | | | | 1 | | | | | | | | | | |
| CO4 | | | | 1 | | | | | | | | | | | | | |
| CO5 | | | | 2 | | | | | | | | | | | | | |
| Average | | | 1 | 2 | | | 1 | | | | | | | | | | |

CE3741

MINI PROJECT

L T P C

0 0 4 2

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information relate to the same through detailed review of literature.
- To develop the methodology to solve the identified problem
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To prepare the final report of project work in standard format.
- To present the work in International/National conference reputed journals.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

On Completion of the project work students will be in a position

1. To take up any challenging practical problems.
2. Find the solution by formulating proper methodology.
3. Understand the modeling, analysis and design concepts by taking up a structure.
4. Gain and solve problems using software knowledge.
5. Able to take up and solve practical problems.

| CE3741 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | - | - | - | - | 1 | 1 | - | - |
| CO2 | - | 1 | - | - | - | - | - | - | 3 | 1 | 2 | 3 | 3 | - | - | - |
| CO3 | - | - | - | - | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | - |
| CO4 | - | - | - | 1 | 3 | - | - | - | - | - | - | 2 | - | - | - | 3 |
| CO5 | - | - | - | 1 | - | - | - | - | 3 | - | - | 2 | - | - | 1 | - |
| Average | 1.0 | 1.5 | 2.0 | 1.0 | 2.0 | 1.0 | 2.0 | 1.0 | 3.0 | 1.0 | 2.0 | 2.3 | 2.0 | 1.5 | 1.5 | 3.0 |

COURSE OBJECTIVES:

- To introduce students to modern design software tools such as AUTO CAD, STAAD, E-TABS, etc., enabling them to navigate and use these tools effectively.
- To train students to apply industry-standard codes and computational tools independently for the design and analysis of reinforced concrete and steel structures.
- To develop students' proficiency in generating comprehensive and accurate structural drawings using design software.
- To provide students with advanced knowledge and skills for designing special reinforced concrete structural members.
- To equip students with the ability to conduct thorough structural analyses of framed structures, including the application of appropriate computational tools, and instill the importance of comprehensive reporting for each design experiment.

LIST OF EXPERIMENTS

- Design and drawing of RC members.
- Design and drawing of special RC Structural Members.
- Design and drawing of RC T beam bridge.
- Design and drawing steel roof truss.
- Design and drawing of steel connections.
- Analysis of Framed Structure.
- Reinforcement details of Various RC Elements

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

On successful completion of this course, students will be able to:

1. Become skilled in using design software like AUTO CAD, STAAD, E-TABS.

2. Independently apply standard codes, computational tools, and software packages to analyze, design, and detail reinforced concrete and steel structures.
3. Generate comprehensive and detailed drawings of structures using design software, showcasing the ability to translate design concepts into practical, visual representations.
4. Understand how buildings work, detail reinforcements, and explain your work clearly in reports..
5. Analyze and design unique concrete structures with advanced principles.

TEXT BOOKS:

1. Krishnaraju.N, — Design of Reinforced Concrete Structures, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016
2. Varghese, P.C., — Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
3. Gambhir. M.L., — Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
4. Subramanian,N., — Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2024.
5. Unnikrishna Pillai, S., Devadas Menon, — Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., 2021.
6. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
7. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009.
8. Rangwala, “ Civil Engineering Drawing: (4th edition), 2024.
9. S.S. Bhavikatti, “design and Drawing of Steel Structures”, (5th edition), 2019.

REFERENCES:

1. IS 456:2000, — Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000

2. SP16, IS 456:1978, — Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999
3. IS 800:2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
4. Jain, A.K., — Limit State Design of RC StructuresII, Nemchand Publications, Roorkee, 1998.
5. Ramachandra, — Limit state Design of Concrete Structures, Standard Book House, New Delhi
6. Ponnuswamy,S., “Bridge Engineering”, Tata McGrawHill,2008
7. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, —Limit State Design of Reinforced Concrete, Laxmi Publication Pvt. Ltd., New Delhi, 2007.

| CE3763 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | - | - | 2 | - | - | 1 | 3 | 1 | 2 | 1 | 1 | 2 | - |
| CO2 | 2 | 2 | - | 2 | - | 2 | - | 2 | 1 | 2 | - | 2 | - | - | 2 | - |
| CO3 | 2 | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | 2 | - | 2 | - | - | 2 | - |
| CO4 | 3 | 2 | 2 | 3 | - | 2 | - | 2 | 2 | 3 | - | 3 | - | 1 | 2 | - |
| CO5 | 2 | 2 | 2 | 2 | - | 2 | 3 | 2 | 2 | 3 | 1 | 3 | 1 | 1 | 2 | - |
| Average | 2.4 | 1.8 | 2.0 | 2.3 | 1.0 | 2.0 | 3.0 | 2.0 | 1.6 | 2.6 | 1.0 | 2.4 | 1.0 | 1.0 | 2.0 | 0.0 |

CE3742

INTERNSHIP

| L | T | P | C |
|----------|----------|----------|----------|
| 0 | 0 | 0 | 1 |

OBJECTIVES:

- To train the students in the field work so as to have a firsthand knowledge of practical Problems related to Structural Engineering in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.
- The students shall be required to present a technical report in PPT and submit a relevant report.
- Seminar is an important component of learning where the student gets acquainted with preparing and presentation of a technical report.
- Presentation schedules will be prepared by the course faculty in line with the academic calendar.

SYLLABUS:

The students individually undertake training in reputed Industries during the summer vacation of fourth and sixth semester for a specified period of two weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. They are trained in tackling a practical field/industry orientated problem related to Structural Engineering.
2. To develop skills in facing and solving the field problems.
3. Training is an important component of learning where the student gets acquainted with preparing and presentation of a technical report.
4. Will have knowledge in different research works related to engineering.
5. Students are trained to face the delegates during their project presentation.

| CE3742 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | - | - | - | - | 2 | - | - | 2 | - | 1 | - | - | - | 3 | - | - |
| CO2 | 2 | 2 | 2 | 2 | 2 | 1 | - | - | - | 2 | - | 2 | 1 | - | 2 | - |
| CO3 | 2 | 2 | 2 | 2 | - | - | 1 | - | 2 | 1 | - | 2 | - | - | - | 3 |
| CO4 | - | - | - | - | 2 | - | - | - | 2 | 1 | - | - | - | 2 | - | - |
| CO5 | 1 | - | - | - | - | - | - | - | 3 | 1 | 2 | - | 3 | - | - | - |
| Average | 1.7 | 2.0 | 2.0 | 2.0 | 2.0 | 1.0 | 1.0 | 2.0 | 2.3 | 1.2 | 2.0 | 2.0 | 2.0 | 2.5 | 2.0 | 3.0 |

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information relate to the same through detailed review of literature.
- To develop the methodology to solve the identified problem
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To prepare the final report of project work in standard format.
- To present the work in International/National conference reputed journals.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 300 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems.
- Find the solution by formulating proper methodology.
- Understand the modeling, analysis and design concepts by taking up a structure.
- Gain and solve problems using software knowledge.
- Able to take up and solve practical problems.

| CE3841 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | - | - | - | - | 1 | 1 | - | - |
| CO2 | - | 1 | - | - | - | - | - | - | 3 | 1 | 2 | 3 | 3 | - | - | - |
| CO3 | - | - | - | - | 2 | - | - | - | - | 2 | 2 | 3 | - | 2 | 2 | - |
| CO4 | - | - | - | 1 | 3 | - | - | - | - | - | - | 2 | - | - | - | 3 |
| CO5 | - | - | - | 1 | - | - | - | - | 3 | - | - | 2 | - | - | 1 | - |
| Average | 1.0 | 1.5 | 2.0 | 1.0 | 2.0 | 1.0 | 2.0 | 1.0 | 3.0 | 1.5 | 2.0 | 2.5 | 2.0 | 1.5 | 1.5 | 3.0 |

MANAGEMENT ELECTIVE

| | | | | | |
|---------------|---------------------------------|----------|----------|----------|----------|
| MAN101 | PRINCIPLES OF MANAGEMENT | L | T | P | C |
| | | 2 | 0 | 0 | 2 |

OBJECTIVES:

- To study the principles of management, functions and their application in an organization.
- To educate the students on the concept of planning and decision-making.
- To understand the dynamics of human relations in organisations.
- To learn about motivation, communication and leadership aspects.
- To study the process of controlling and the various techniques involved in controlling.

UNIT- I INTRODUCTION TO MANAGEMENT 6

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers managerial roles and skills –Evolution of Management – Scientific, human relations, system and contingency approaches. Current trends and issues in Management.

UNIT- II PLANNING 6

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management –types of strategies.

UNIT- III ORGANISING 6

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning.

UNIT- IV DIRECTING 6

Motivation – motivation theories – motivational techniques – job satisfaction – job

enrichment – leadership – types and theories of leadership – communication – the process of communication – barrier in communication.

UNIT- V CONTROLLING

6

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Quality control and Inventory Control - Productivity problems and management.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will be able to have a clear understanding of managerial functions.
2. Students would have the knowledge to apply planning techniques and decision-making.
3. Understand the concept of Human Resource Management.
4. Students would be able to understand motivation, leadership and communication principles.
5. Students would be able to apply control techniques in the organization.

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, 14th Edition, Pearson, 2017
2. AF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson, 2004.

REFERENCE BOOKS:

1. R.S.N. Pillai, S.Kala, Principles of Management, S. Chand Publishing, 2013.
2. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” 10th Edition, Pearson Education, 2016.
3. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
4. Harold Koontz & Heinz Weihrich “Essentials of management” Tata Mc Graw Hill, 2006.
5. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 6th edition 2017.

| MAN101 | PO | | | | | | | | | | | | PSO | | | | |
|----------------|-----|-----|-----|---|-----|---|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 1 | | | | | | | | | | | | | | | | |
| CO2 | | 2 | | | | | | | | | | | | | | | |
| CO3 | | | | | 1 | | | | | | | | | | | | |
| CO4 | | | 1 | | | | | | | | | | | | | | |
| CO5 | | 1 | | | | | | | | | | | | | | | |
| Average | 1.0 | 2.0 | 1.0 | | 1.0 | | | | | | | | | | | | |

| | | | | | |
|---------------|---------------------------------|----------|----------|----------|----------|
| MAN102 | TOTAL QUALITY MANAGEMENT | L | T | P | C |
| | | 2 | 0 | 0 | 2 |

OBJECTIVES:

- To understand the Total Quality Management Concepts and Dimensions of Customers quality.
- To familiarise the various contributions of Quality Gurus.
- To understand the Framework of Quality Management.
- To educate about tools and techniques in Quality Management.
- To impart knowledge to implement the Quality Management System.

UNIT- I INTRODUCTION 6

Introduction - Need for quality - Evolution of quality - Definition of quality, Benefits & Obstacles, Quality – vision, mission and policy statements - Attitude and involvement of top management, Customer Focus – customer perception - Customer retention. Introduction to SERVQUAL.

UNIT- II OVERVIEW OF THE CONTRIBUTIONS 6

Philosophies of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa - Concept of Quality circle.

UNIT- III TQM FRAMEWORK 6

Culture, Leadership – Quality Council, Employee Involvement, Motivation, Empowerment, Recognition and Rewards, International/National Quality Awards.

UNIT- IV TOOLS AND TECHNIQUES 6

Six Sigma, Kaizen, 5S, 7QC Tools, Quality function deployment (QFD) – Benefits, Voice of customer, Information Organization, Building a House of Quality (HOQ), Bench marking and Poka-Yoke.

UNIT- V QUALITY MANAGEMENT 6

Quality Audits – Quality Council. ISO 9001:2015 (Quality Management) AS9100

(Aerospace), ISO 14001(Environment), ISO/TS 16949 (Automotive), ISO 17025 (Testing/FDA), TL 9000 (Telecommunication), ISO 13485 (Medical Devices), ISO 27001 (Information Security), ISO 29001 (Oil / Gas).

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will have an understanding of Quality Management concepts and Customers
2. Students will be able to apply Quality principles provided by the authors and implement.
3. Students will have an understanding of Framework of Quality Management.
4. Students will be able to apply tools and techniques to improve business process.
5. Students will be able to understand Quality System available.

REFERENCE BOOKS:

1. James R. Evans, William M.Lindsay, "Total Quality Mangement"10 th Edition, Cengage, Phillippine Edition, 2019.
2. Ray Tricker, Quality Management Systems: A Practical Guide to Standards Implementation, Routledge; 1st edition, 2019
3. Poornima M. Charantimath, Total Quality Management, Pearson Education, 2 nd Edition,2017.
4. Dale H. Besterfield, Carol Besterfield, Michna, Glen H. Besterfield, Mary Besterfield, Sacre, Hermant, Urdhwareshe, Rashmi Urdhwareshe, Total Quality Management, Revised 4 th Edition, Pearson Education, 2013.
5. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, 2 nd Edition 2010.
6. Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley Student Edition, 7 th Edition, Wiley India Pvt Limited, 2012.
7. Indian Standards – Quality management systems – Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi.

| MAN102 | PO | | | | | | | | | | | | PSO | | | | |
|----------------|-----|-----|---|-----|---|---|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | | | | 1 | | | | | | | | | | | | | |
| CO2 | 1 | | | | | | | | | | | | | | | | |
| CO3 | | | | 1 | | | | | | | | | | | | | |
| CO4 | | 2 | | | | | | | | | | | | | | | |
| CO5 | | | | 1 | | | | | | | | | | | | | |
| Average | 1.0 | 2.0 | | 1.0 | | | | | | | | | | | | | |

| | | | | | |
|---------------|-----------------------------------|----------|----------|----------|----------|
| MAN103 | HUMAN RESOURCES MANAGEMENT | L | T | P | C |
| | | 2 | 0 | 0 | 2 |

OBJECTIVES:

- To enable students to gain knowledge on Human resource management concepts and principles.
- To familiarise students about HRP process and Job Analysis.
- To illustrate the techniques and tools for Training and Development and Performance appraisal.
- Students will be able to illustrate the techniques and tools for compensation.
- To understand concepts of Performance evaluation, Industrial Relations System and Grievance redressal mechanism.

UNIT- I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 6

Meaning – Definition – Nature – Scope and significance – Evolutionary growth of HRM – Functions of HRM - Role of Human resource manager – Personnel Management vs HRM.

UNIT- II TALENT MANAGEMENT 6

Job Analysis – Job description & specification - Human Resource Planning – Forecasting human resource requirement –Recruitment - Selection –Induction.

UNIT- III TRAINING AND DEVELOPMENT 6

Need for Training – Process -Types of Training methods – On the job & Off the job - Purpose – Benefits – Management development programmes – Training vs Development -Effectiveness of training.

UNIT- IV COMPENSATION MANAGEMENT 6

Introduction – Compensation – Forms & Types of compensation – Determinants of compensation – Components of Pay structure – Significance in Employee morale.

UNIT- V PERFORMANCE MANAGEMENT AND CONTROL PROCESS 6

Performance Management System – Process – Appraisal methods – Evaluation of managerial Implications – Control process – Importance – Methods – Requirement of effective control systems.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will be able to gain knowledge on Human resource management concepts and principles.
2. Students will be able to do human forecasting and handle HRM issues in the context of outsourcing.
3. Students will be able to design and implement appropriate Training and Development programmes.
4. Students will be able to develop relevant Compensation system to meet individual and organisational strategic needs.
5. Students can develop Performance appraisal system and effectively handle Disciplinary and grievance mechanisms.

REFERENCE BOOKS:

1. Gary Dezzler & Biju Vaarkey, Human Resource Management, Pearson 16th edition 2020.
2. S S Khanka, Human Resource Management (Text and Cases), S. Chand Publishing, 2019.
3. Decenzo and Robbins, Fundamentals of Human Resource Management, Wiley, 11th Edition, 2013.
4. Luis R. Gomez-Mejia, David B. Balkin, Robert L Cardy, Managing Human Resource, PHILearning, 2012.
5. Bernadin, Human Resource Management, Tata Mc Graw Hill, 8th Edition 2012.
6. Wayne Cascio, Managing Human Resource, Mc Graw Hill, 9th Edition, 2012.
7. Ivancevich, Human Resource Management, Mc Graw Hill, 2012.

8. Uday Kumar Haldar, Juthika Sarkar. Human Resource Management, Oxford 2012.

| MAN103 | PO | | | | | | | | | | | | PSO | | | | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | | | | 1 | | | | | | | | | | | | | |
| CO2 | | 1 | | | | | | | | | | | | | | | |
| CO3 | | | | 1 | | | | | | | | | | | | | |
| CO4 | | 1 | | | | | | | | | | | | | | | |
| CO5 | | | | 1 | | | | | | | | | | | | | |
| Average | | 1.0 | | 1.0 | | | | | | | | | | | | | |

| | | | | | |
|---------------|-------------------------------------|----------|----------|----------|----------|
| MAN104 | ENTREPRENEURSHIP DEVELOPMENT | L | T | P | C |
| | | 2 | 0 | 0 | 2 |

OBJECTIVES:

- Develop and strengthen entrepreneurial qualities and entrepreneur's role in economic growth
- Impart understanding on Entrepreneurial Training and Development Programs.
- Develop understanding on the business environment and to manage projects.
- Create an understanding on project finance and accounting principles
- Create awareness on entrepreneurial support offered through government agencies and schemes.

UNIT- I INTRODUCTION 6

Entrepreneur – Types of Entrepreneurs – Entrepreneurship as a Career – Entrepreneurial Personality - women entrepreneurship, rural and urban entrepreneurship, Entrepreneur – Knowledge and Skills of Entrepreneur. Difference between Entrepreneur and Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT- II ENTREPRENEURIAL MOTIVATION 6

Major Motives Influencing an Entrepreneur, motivation theories-Maslow's Need Hierarchy Theory – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT- III BUSINESS ENVIRONMENT AND PROJECT MANAGEMENT 6

Business Environment - Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs

4. EDII “Faculty and External Experts – A Hand Book for New Entrepreneurs
Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad,
1986.

| MAN104 | PO | | | | | | | | | | | | PSO | | | | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 1 | | | | | | | | | | | | | | | | |
| CO2 | | | | 1 | | | | | | | | | | | | | |
| CO3 | | | | 1 | | | | | | | | | | | | | |
| CO4 | | 2 | | | | | | | | | | | | | | | |
| CO5 | | | | 1 | | | | | | | | | | | | | |
| Average | 1.0 | 2.0 | | 1.0 | | | | | | | | | | | | | |

Groups and Micro Credit.

UNIT- V WOMEN DEVELOPMENT

9

Theories of Development, Alternative approaches – Women in Development (WID), Women and Development (WAD) and Gender and Development (GAD) - Empowerment- Concept and indices: Gender Development Index (GDI), Gender Inequality Index (GII), Global Gender Gap Index (GGGI) - Women Development approaches in Indian Five – Year Plans - Women and leadership– Panchayati Raj and Role of NGOs and Women Development - Sustainable Development Goals, Policies and Programmes.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will have an understanding on gender and its operations on Institutional and cultural context.
2. Students will be able to understand about gender roles in society.
3. Students will be able to understand the institutions of family and its influence on women's status.
4. Students will be educated on the gender issues.
5. Students will be familiarized on women development with gender perspective.

REFERENCE BOOKS:

1. Susan Shaw and Janet Lee, Women's Voices, Feminist Visions, McGraw Hill Pub, 6 th edition, 2014.
2. Rege, Sharmila (ed), Sociology of Gender: The Challenge of Feminist Sociological Knowledge, Sage, New Delhi, 2003.
3. Bonnie G. Smith, 2013 Women's Studies: the Basics, Routledge
4. Uma Chakravarti. Gendering Caste: Through a Feminist Lens. Sage, 2018.

| MBA101 | PO | | | | | | | | | | | | PSO | | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | | | | | | | 1 | | | | | | | | | | |
| CO2 | | | | | | | 1 | | | | | | | | | | |
| CO3 | | | | 1 | | | | | | | | | | | | | |
| CO4 | | | | | | | 1 | | | | | | | | | | |
| CO5 | | | | | | | 1 | | | | | | | | | | |
| Average | | | | 1 | | | 1 | | | | | | | | | | |

REFERENCE BOOKS:

1. Seasons of Life: A Poetic Anthology (Literary Classics) by Nigel Collins, Jim Herrick, John Pearce (ISBN: 9781573927710)
Web Link :<https://www.amazon.co.uk/Seasons-Life-Anthology-Literary-Classics/dp/1573927716>
2. New One-Act Plays for Acting Students: A New Anthology of Complete One-Act Plays for One, Two or Three Actors Paperback – by Norman Bert (Author), Deb Bert (Editor)
Web Link : <https://www.amazon.in/New-One-Act-Plays-Acting-Students/dp/1566080843>
3. Student Text (Drama Essentials: An Anthology of Plays) Paperback – by Matthew C. Roudane (Editor)
Web Link : <https://www.amazon.in/Drama-Essentials-Student-Anthology-Plays/dp/0618474773>
4. Famous Novels and Short stories in English.(to be recommended by teachers to individual students)
5. Collection of poems by Robert Frost, William Wordsworth, Rabindranath Tagore, Walt Whitman , Maya Angelou, Rudyard Kipling (to be recommended by teachers to individual students)

| | | | | | |
|---------------|--------------------------------------|----------|----------|----------|----------|
| MBA102 | PATENT DRAFTING FOR BEGINNERS | L | T | P | C |
| | | 3 | 0 | 0 | 0 |

OBJECTIVES:

- To recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Rights.
- To identify the significance of practice and procedure of Patents.
- To make the students to understand the statutory provisions of different forms of IPRs in simple forms.
- To learn the procedure of obtaining Patents, Copyrights, Trade Marks & Industrial Design
- To enable the students to keep their IP rights alive.

UNIT- I UNDERSTANDING AND OVER VIEW OF THE IPR REGIME 9

Introduction, types of intellectual property- Industrial property, Artistic and literary Property, Need for intellectual property rights, Rationale for protection of IPR, Impact of IPR on development, health, agriculture, and genetic resources, IPR in India- Genesis and development, IPR in abroad- some important examples of IPR, International organizations, agencies, and treaties.

UNIT- II PATENTS 9

Need for patent, Macro-economic impact of the patent system, Classification of patents in India, Classification of patents by WIPO, Categories of Patent, Special Patents, Patenting Biological products, Patent document, Granting of patent, Rights of a patent, Patent Searching, Patent Drafting, filing of a patent, different layers of the international patent system, Utility models, Case Study.

UNIT- III COPYRIGHT 9

Rights and protection covered by copy right- law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, obtaining copyright registration, notice of copy rights, international copyright law, infringement of copy right under copyright Act.

5. Pandey, Neeraj, Dharni, Khushdeep, Intellectual Property Rights, PHI, 2020.
6. Sople, Vinod V. Managing Intellectual Property: The Strategic Imperative, PHI, 2020.

| MBA102 | PO | | | | | | | | | | | | PSO | | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | | | | 1 | | | | | | | | | | | | | |
| CO2 | 1 | | | | | | | | | | | | | | | | |
| CO3 | | | | 1 | | | | | | | | | | | | | |
| CO4 | | 2 | | | | | | | | | | | | | | | |
| CO5 | | | | 1 | | | | | | | | | | | | | |
| Average | 1 | 2 | | 1 | | | | | | | | | | | | | |

MBA103

INDUSTRIAL PSYCHOLOGY

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

OBJECTIVES:

- To understand the core concepts, history, and significance of Industrial Psychology
- To analyze factors influencing employee attitudes, behaviors, and well-being.
- To apply principles of ergonomics and human factors to improve workplace design and safety.
- To evaluate different theories of motivation and their practical applications in organizational settings.
- To assess team dynamics, cultural diversity, and organizational change processes in modern workplaces.

UNIT- I FOUNDATIONS OF INDUSTRIAL PSYCHOLOGY AND JOB 9
ANALYSIS

Definition, Characteristics, Goals, and Importance of Industrial Psychology - Brief History of Industrial Psychology - Major Fields in Industrial Psychology - Research Methods in Industrial Psychology - Job Analysis: Methods and Techniques - Performance Measurement: Concepts and Practices - Performance Rating and Evaluation - The Social Context of Performance Evaluation.

UNIT- II EMPLOYEE ATTITUDES, BEHAVIOUR, AND WELL-BEING 9

Work Attitudes and Employee Engagement - Job Satisfaction and Organizational Commitment - Positive Employee Behaviors - Worker Stress: Sources, Consequences, and Coping Strategies.

UNIT- III ERGONOMICS AND ENGINEERING PSYCHOLOGY 9

Principles of Ergonomics and Human Factors - Work Design for Productivity and Well-being - Psychological Aspects of Workplace Safety - Human-Technology

3. Riggio, R. E. (2017). Introduction to Industrial and Organizational Psychology (6th Edition), Routledge.
4. Salvendy, G. (2006). Handbook of human factors and ergonomics (3rd ed.). New York: Wiley.
5. Levy, P. E. (2017). Industrial/Organizational Psychology: Understanding the Workplace (5th Edition), Macmillan Learning
6. Culbertson, S. S., & Muchinsky, P. M. (2022). Psychology Applied to Work (13th Edition), Hypergraphic Press.
7. Spector, P. E. (2017). Industrial and Organizational Psychology: Research and Practice (7th Edition), Wiley.
8. Truxillo, D. M., Bauer, T. N., & Erdogan, B. (2016). Psychology and Work: Perspectives on Industrial and Organizational Psychology (1st Edition), Routledge.

| MBA103 | PO | | | | | | | | | | | | PSO | | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 3 | | | 1 | | | | 1 | | | | | | | | | |
| CO2 | | 3 | 2 | | 1 | | 1 | | | | | | | | | | |
| CO3 | 1 | | | | | 1 | | | | | | | | | | | |
| CO4 | 2 | | 2 | | 1 | | 1 | | | | | | | | | | |
| CO5 | | | | 3 | | | | 2 | | | | | | | | | |
| Average | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | | | | | | | | | |

OBJECTIVES:

- To create an awareness on the constitution of India and its amendments.
- To educate the students with fundamental duties and rights of the citizens.
- To equip with the functions of central government and its' structure.
- To learn the state government structure and its' functions.
- To understand the judiciary structure and its functions in India.

UNIT- I INTRODUCTION 9

Introduction to constitution of India – Philosophical Foundations and Historical Background – Preamble – Schedule – 42nd Amendment - 44th Amendment – 73rd Amendment - 74th Amendment – Articles Related to Amendments.

UNIT- II FUNDAMENTAL DUTIES AND RIGHTS OF CITIZENS 9

Citizenship – Citizenship Amendment Act (CAA) – Union of States - Union Territories - Fundamental Rights – Directive Principles of State Policy (DPSP) – Fundamental Duties - Reference of Articles for Granting of Special Status to Various States in the Country.

UNIT- III CENTRAL GOVERNMENT STRUCTURE AND FUNCTIONS 9

Government at Central Level – President of India – Powers of President of India – Structure of Central Government – Functions of Central Government – Vice President – Powers of Vice President – Powers of Prime Minister – Powers of Cabinet Ministers – Powers of Parliament.

UNIT- IV STATE GOVERNMENT STRUCTURE AND FUNCTIONIONS 9

Government at State Level – Structure of State Government – Functions of State Government – Governor – Powers of Governor – Chief Minister – Powers of Chief Minister – State Legislature – Powers of Cabinet Ministers in State Legislature – Cabinet Ministers Responsibilities in State Government.

UNIT- V JUDICIARY STRUCTURE AND FUNCTIONS**9**

Supreme Court of India – Judiciary System in Indian Constitution – Judicial Systems
 Central Government Level – Judiciary System in State Government Level – High
 Courts and Subordinate Courts – Election Commission of India – Case Studies of
 Major Disputes.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. Students will be able to understand the constitution of India and its' amendments.
2. Students will be able to analyze the fundamental duties and rights of citizens.
3. Students will be able to narrate the central government structure and its functions.
4. Students will be able to discuss the state government structure and its functions
5. Students will be able to derive judiciary structure and its functions.

REFERENCE BOOKS:

1. Basu, D. D. (1966). Introduction to the Constitution of India. LexisNexis, India.
2. Khosla, Madhav (2012). The Indian Constitution. Oxford University Press, India.
3. R.C.Agarwal (1997). Indian Political System. SChand Company Ltd., India.
4. Bakshi, P. (2023). The Constitution of India. LexisNexis, India.
5. V. N. Shukla (2017). Constitution of India, 13th Ed., Eastern Book Company.

| MBA104 | PO | | | | | | | | | | | | PSO | | | | |
|---------|----|---|-----|-----|-----|-----|---|---|---|----|----|----|-----|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 2 | | | 1 | | | | 1 | | | | | | | | | |
| CO2 | 2 | | 3 | 2 | 3 | 3 | 1 | 1 | | | | | | | | | |
| CO3 | 2 | 3 | 2 | 1 | | 1 | | | | | | | | | | | |
| CO4 | 2 | | 2 | 1 | | 1 | | | | | | | | | | | |
| CO5 | 2 | | 2 | 1 | 2 | 1 | 1 | | | | | | | | | | |
| Average | 2 | 3 | 1.8 | 1.2 | 2.5 | 1.5 | 1 | 1 | | | | | | | | | |

UNIT- II DIET

4+6

Role of diet in maintaining health - energy one needs to keep active throughout the day – nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong. **Balanced Diet and its 7 Components** - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions.

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes. Different cooking methods, merits and demerits of each method.

UNIT- III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH

4+4

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal.

Prevention of illness with our traditional system of medicine

Primary Prevention - To decrease the number of new cases of a disorder or illness – Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention – To decrease the amount of disability associated with an existing disorder.

UNIT- IV MENTAL WELLNESS

3+4

Emotional health - Definition and types - Three key elements: the subjective experience – the physiological response - the behavioural response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances – Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stress management - Stress definition - Stress in daily life - How stress affects one's life -Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

Sleep - Sleep and its importance for mental wellness - Sleep and digestion.

Immunity - Types and importance - Ways to develop immunity.

UNIT- V YOGA

2+12

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for Individuals according to the Age - The Eight Limbs of Yoga - Simple yoga asanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL : 45 PERIODS (Lecture 19 + Practice 26)

COURSE OUTCOMES:

After completing the course, the students will be able to:

1. Learn the importance of different components of health.
2. Gain confidence to lead a healthy life.
3. Learn new techniques to prevent lifestyle health disorders.

4. Understand the importance of diet and workouts in maintaining health.
5. Understand the practice of yoga.

TEXTBOOKS:

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California
3. Yoga and Empowerment, WCSC-VISION for Wisdom, 3rd Edition 2018, Vethathiri Publications, Erode.
4. SIDDHA MEDICINE HANDBOOK OF TRADITIONAL REMEDIES Kindle Edition by Paul Joseph Thottam (Author) 2012.
5. The Ayurvedic Pharmacopoeia of India Part-I Volume-VII First Edition [Minerals & Metals] by Central Council for Research in Ayurveda and Siddha, 2008.

REFERENCE BOOKS:

1. What we know about emotional intelligence how it affects learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England.
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001.
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/>
4. Simple lifestyle modifications to maintain health <https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-betterhealth#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.>

5. Read more: <https://www.legit.ng/1163909-classes-food-examples-functions.html>
6. <https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926>
7. Benefits of healthy eating <https://www.cdc.gov/nutrition/resources-publications/benefitsof-healthy-eating.html>
8. Food additives
<https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food-additives>
9. BMI <https://www.hsph.harvard.edu/nutritionsource/healthy-weight/>
<https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---whorecommendations>
10. Yoga <https://www.healthifyme.com/blog/types-of-yoga/>
<https://yogamedicine.com/guide-types-yoga-styles/>
11. Ayurveda : <https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda>
12. Siddha: http://www.tkd.res.in/tkd/langdefault/Siddha/Sid_Siddha_Concepts.asp

UNIT- III SCIENCE AND TECHNOLOGY IN COLONIAL INDIA 9

Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company's Service- Indian Response to new Scientific Knowledge, Science and Technology in Modern India- Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites.

**UNIT- IV IMPACT OF SCIENCE AND TECHNOLOGY IN MAJOR 9
AREAS**

Space – Objectives of space programs, Geostationary Satellite Services – INSAT system and INSAT services remote sensing applications, Launch Vehicle Technology.

Ocean Development – Objectives of ocean development, Biological and mineral resources, Marine research and capacity building. Defence Research – Spin-off technologies for civilian use, Biotechnology – Applications of biotechnology in medicine, Biocatalysts, Agriculture, Food, Fuel and Fodder, Development of biosensors and animal husbandry
Energy – Research and development in conservation of energy, India's nuclear energy program, technology spin-offs.

**UNIT- V NEXUS BETWEEN TECHNOLOGY TRANSFER AND 9
DEVELOPMENT**

Transfer of Technology – Types, Methods, Mechanisms, Process, Channels and Techniques, Appropriate technology- Criteria and selection of Appropriate technology: Technology assessment, Technological forecasting, Technological innovations and barriers of technological change. Social implications of new technologies like the Information Technology and Biotechnology

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. The origins of scientific knowledge, Names, major milestones in the life and

work of prominent scientists and engineers.

2. Periodization of the history of science and technology.
3. Major events, dates of the most significant achievements in the development of science and technology at different stages of history;
4. Features of the network of scientific and technical institutions, the history of formation and development of leading research centers, in particular higher education institutions as centers of basic and applied research.
5. Features of science and technology and its development

TEXTBOOKS:

1. Kalpana Rajaram, Science and Technology in India, Published and Distributed by Spectrum Books (P) Ltd., New Delhi – 58.
2. Srinivasan, M., Management of Science and Technology (Problems & Prospects), East-West Press (P) Ltd., New Delhi.

REFERENCE BOOKS:

1. Ramasamy, K.A., and Seshagiri Rao, K., (Eds), Science, Technology and education for Development, K., Nayudamma Memorial Science Foundation, Chennai – 8.
2. Kohli, G.R., The Role and Impact of Science and Technology in the Development of India, Surjeet Publications. Government of India, Five Year Plans, Planning Commission, New Delhi.
3. Government of India, Five Year Plans, Planning Commission, New Delhi.
4. Sharma K.D., and Quresh M.A., Science, Technology and Development, Sterling Publications (P) Ltd., New Delhi.

ONLINE LINK

Swayam online course History of Science and Technology:

https://onlinecourses.swayam2.ac.in/arp19_ap87/preview

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| MCY201 | AWARENESS OF CYBER SECURITY AND CYBER LAW | L | T | P | C |
| | | 3 | 0 | 0 | 0 |

OBJECTIVES:

- To understand the basics of cyber security and cyber law.
- To understand the problems and issues associated with it.
- To understand the various act or regulations.
- To understand the various approaches for incident analysis and response.
- To understand the ethical laws of computer for different countries.

UNIT- I INTRODUCTION TO CYBER SECURITY AND CYBER CRIME 9

Introduction–Cyber Crime: Definition and origins– Cyber crime and information Security– Cyber criminals– Classification of Cyber crimes.

UNIT- II LEGAL PERSPECTIVES 9

Introduction to the Legal Perspectives of Cybercrimes and Cyber security, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India.

UNIT- III CYBER ACT 9

Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Cybercrime and Punishment, Cyber law, Technology and Students: Indian Scenario.

UNIT- IV CYBER LIABILITY 9

Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right–source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Losing.

UNIT- V CYBER CHANGES 9

Ethics, Legal Developments, Cyber security in Society, Security in cyber lawscase studies, General law and Cyber Law–a Swift Analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

- Understand key terms and concepts in cyber security and cyber law, intellectual property and cyber– crimes, trademarks and domain theft.
- Determine computer technologies, digital evidence collection.
- Determine evidentiary reporting in forensic acquisition.
- Secure both clean and corrupted systems, protecting personal data, securing simple computer networks, and safe Internet usage.
- Incorporate approaches for incident analysis and response.

TEXTBOOKS:

1. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, WileyIndia Pvt. Ltd, 2011.
2. Jonathan Rosenoer, “Cyber Law: The law of the Internet”, Springer–Verla..

REFERENCE BOOKS:

1. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge University Press, 2006.
2. 2. Dr. Farooq Ahmad, Cyber Law in India, Allahbad Law Agency– Faridabad.

| MCY201 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|-----|---|---|---|---|---|---|---|----|----|----|-----|---|---|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | | | | | | | | | | | 2 | 1 | | | |
| CO2 | | 2 | | 2 | | 2 | | | | | | | | | 2 | 2 |
| CO3 | | | | | | | | 2 | | | | | 1 | | | |
| CO4 | | 3 | 2 | | | | | 2 | | | | 2 | | | 2 | 1 |
| CO5 | 2 | | | | | 2 | | | | | | | | 2 | | |
| Average | 2 | 2.5 | 2 | 2 | | 2 | | 2 | | | | 2 | 1 | 2 | 2 | 1.5 |

document, Planning matrix, Investigators Kit, Functions of investigator, Four types of evidences, Records of accidents, Accident reports Class exercise with case study.

UNIT- IV SAFETY PERFORMANCE MONITORING 9

Reactive and proactive monitoring techniques, Permanent total disabilities, Permanent partial disabilities, Temporary total disabilities - Calculation of accident indices, Frequency rate, Severity rate, Frequency severity incidence, Incident rate, Accident rate, Safety “t” score, Safety activity rate problems.

UNIT- V SAFETY EDUCATION AND TRAINING 9

Importance of training identification of training needs training methods – programme, seminars, conferences, competitions – method of promoting safe practice motivation – communication role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Learn the basic approaches of the organizations and safety management
2. Perform work design and facility planning
3. Study the accident investigation process and accident reports
4. Learn the principles of safety performance monitoring
5. Study the methods of safety education and training

TEXTBOOKS:

1. L M Deshmukh, Industrial safety management, TATA McGraw Hill, 2017.
2. Heinrich H.W., Industrial Accident Prevention, McGraw Hill Company, New York, 2001.

REFERENCE BOOKS:

1. Garg, HP, Maintenance Engineering, S. Chand Publishing, 2012
2. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.

| MME201 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|----------|----------|---|----------|----------|----------|----------|----------|----------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | | 1 | | | 2 | | | 1 | | | 2 | 1 | | | |
| CO2 | | 1 | | 2 | | | | 2 | | | 1 | | 1 | | | |
| CO3 | 2 | | | 2 | | | 1 | | | 2 | | 2 | 1 | | | |
| CO4 | 2 | | 3 | | | 2 | | | 2 | | 1 | | 1 | | | |
| CO5 | | 2 | | | 2 | | | 1 | | | | 1 | 1 | | | |
| Average | 3 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | | | |

VERTICAL - I : STRUCTURAL ENGINEERING

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| PCE101 | REPAIR AND REHABILITATION OF STRUCTURES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To impart knowledge about Inspection, Assessment, Repair strategies and Maintenance of structures.
- To explain durability aspects, causes of deterioration and assessment of distressed structures.
- To make familiar with different types of special concrete for repair of structures
- To demonstrate Non-destructive testing methods for evaluating the properties of concrete
- To acquire knowledge of repairing of structures and demolition procedures

UNIT- I INTRODUCTION TO MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure.

UNIT- II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability and Thermal properties of concrete - Cracks, different types, causes – Effects due to climate, temperature- Effects of cover thickness.

UNIT- III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Ferro cement concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

REFERENCE BOOKS:

1. Failures and repair of concrete structures by Champion, John Wiley and Sons, 1961.
2. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai.
3. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India
4. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House, 2010.

| PCE101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 3 | - | - | 2 | - | 1 | - | 2 | - | 2 | - | 2 | - | 2 |
| CO2 | 1 | - | - | 2 | - | 2 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | - | 1 |
| CO3 | 1 | 2 | - | 1 | - | 3 | 1 | 2 | - | - | - | - | - | 3 | - | 2 |
| CO4 | 2 | 1 | 3 | 1 | - | - | - | - | - | - | 2 | 2 | - | - | 2 | 2 |
| CO5 | - | 1 | 2 | - | 2 | - | 2 | 2 | - | - | - | 2 | - | - | - | - |
| Average | 1.5 | 1.5 | 2.7 | 1.3 | 2.0 | 2.3 | 1.5 | 1.7 | 1.0 | 1.5 | 1.5 | 2.0 | 3.0 | 2.3 | 2.0 | 1.8 |

| | | | | | |
|---------------|---------------------------------|----------|----------|----------|----------|
| PCE102 | PREFABRICATED STRUCTURES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To impart knowledge to students on modular construction.
- To design the prefabricated components.
- To adopt design philosophy based on material efficiency.
- To design connections between Structural members.
- To apply Codal provisions.

UNIT-I INTRODUCTION 9

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standardization- Loads and load combinations- Materials – Production -Transportation – Erection.

UNIT-II PREFABRICATED COMPONENTS 9

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT-III DESIGN PRINCIPLES 9

Design philosophy- Design of cross section based on efficiency. Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT-IV JOINT IN STRUCTURAL MEMBERS 9

Joints for different structural connections–Dimensions and detailing–Design of expansion joints

UNIT-V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. To use modular construction, industrialized construction
2. To design prefabricated elements

3. To design some of the prefabricated elements
4. To Use the knowledge of the construction methods and prefabricated elements in buildings
5. To use the knowledge of codal provisions related to design of abnormal loads.

TEXTBOOKS:

1. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.
2. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, "Precast Concrete Structures", (2nd Edition, 2019)
3. Kim S. Elliott, "Precast Concrete Structures" (2nd Edition, 2019).
4. Kim S. Elliott, Mark Magill, "Precast Prestressed Concrete for Building Structures",(2024).
5. Dr. R. Saravanan, Dr. R. Dinesh Kumar, Dr. R. Subhaja, "Prefabricated Structures", (2021)

REFERENCE BOOKS:

1. Koncz T., "Manual of precast concrete construction", Vol.I, II and III, Bauverlag, GMBH,1976.
2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.
3. Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

| PCE102 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 2 | 1 | 2 | - | 3 | 2 | 1 | - | 3 | 2 | 1 | 1 |
| CO2 | - | - | - | - | 1 | 1 | - | 2 | - | - | - | - | 1 | - | 1 | - |
| CO3 | - | 2 | - | 2 | - | 1 | - | - | - | 2 | - | - | 1 | - | 2 | - |
| CO4 | 1 | - | 2 | - | 3 | - | 1 | - | - | - | 3 | 1 | - | 2 | - | - |
| CO5 | 1 | 1 | 2 | - | - | - | 1 | 1 | - | - | - | 1 | 3 | - | - | 1 |
| Average | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 |

OBJECTIVES:

The course prepares

- To identify whether a structure is statically determinate or indeterminate
- To make a clear understanding of the displacement method and its application to idealized structural models
- To understand and perform the analysis of indeterminate arches.
- To provide a basic understanding of elasticity and its role in structural analysis
- To develop an understanding of structural plastic behavior and its application to the analysis and design of structures.

UNIT- I FORCE METHOD OF STRUCTURAL ANALYSIS 9

Review of energy principles, Static Indeterminacy, Force method- concept of flexibility, Matrix approach, application to beam, plane truss and plane frame.

UNIT- II DISPLACEMENT METHOD OF STRUCTURAL ANALYSIS 9

Kinematic Indeterminacy, degrees of freedom, Concept of stiffness, Slope-deflection Method applications to beam, plane truss and plane frame, Matrix approach.

UNIT- III ANALYSIS OF INDETERMINATE ARCHES 9

Applications of Energy Theorems: Analysis of Two Hinged Arches, Fixed Symmetrical Arches -Elastic Centre Method Rib shortening, Temperature Stresses

UNIT- IV THEORY OF ELASTICITY OF STRUCTURES 9

Theory of Elasticity -Generalized Hooke's law, Strain displacement relation, strain compatibility equations, Plane stress and Plane strain conditions.

UNIT- V THEORY OF PLASTICITY OF STRUCTURES

9

Plastic Analysis- Introduction, shape factor, plastic modulus of section, plastic hinge, Collapse Mechanisms, Upper Bound and Lower Bound Theorems, Applications to beams and single bay single storey portal frames.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course,

1. The student will demonstrate the ability to apply the Force Method for analyzing structural systems
2. The student will be able to analyze beams using the Displacement Method of Structural Analysis.
3. The student will be able to analyze statically indeterminate arches.
4. The student will be able to analyze the elastic behavior of structural elements
5. The student will be able to analyze the plastic behavior of structural components.

TEXTBOOKS:

1. Timoshenko S.P. and Young D.H., Theory of Structures, Tata McGraw Hill, New Delhi, 2017
2. C.K. Wang, Indeterminate Structural Analysis, Tata McGraw Hill, New Delhi, 2017.
3. C.K. Wang, "Indeterminate Structural Analysis", 2017.
4. R.C. Hibbeler, "Structural Analysis", 2022

REFERENCE BOOKS:

1. Russell C. Hibbeler, Structural Analysis, Pearson Education, India
2. Devdas Menon, Structural Analysis, Narosa Publications, New Delhi
3. C.S. Reddy, Basic Structural Analysis, Tata McGraw Hill, New Delhi
4. S. Ramamrutham and N. Narayan, Theory of Structures, Dhanpat Rai, New

Delhi.

5. N.C. Sinha and P.K. Gayen, Advanced Theory of Structures, Dhanpat Rai, New Delhi.

| PCE103 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 2 | 1 | 2 | - | 3 | 2 | 1 | - | 3 | 2 | 1 | 1 |
| CO2 | - | - | - | - | 1 | 1 | - | 2 | - | - | - | - | 1 | - | 1 | - |
| CO3 | - | 2 | - | 2 | - | 1 | - | - | - | 2 | - | - | 1 | - | 2 | - |
| CO4 | 1 | - | 2 | - | 3 | - | 1 | - | - | - | 3 | 1 | - | 2 | - | - |
| CO5 | 1 | 1 | 2 | - | - | - | 1 | 1 | - | - | - | 1 | 3 | - | - | 1 |
| Average | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 |

structures.

UNIT- V DESIGN OF COMPOSITE MEMBERS

9

Composite beams- analysis and design, ultimate strength- their applications. Partial prestressing- its advantages and applications.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. To Understand and apply the basic concepts and principles underlying prestressing techniques in concrete structures.
2. Analyze the behavior of prestressed concrete flexural members under different loading conditions.
3. To understand and apply different techniques to achieve continuity in prestressed concrete beams.
4. To understand the structural behavior and failure modes of prestressed tension and compression members in various engineering applications.
5. Analyze and design composite prestressed concrete members

TEXTBOOKS:

1. Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2018
2. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi, 2017
3. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt.Ltd., New Delhi, 2017.
4. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd., 2018.
5. Dr. Praveen Nagarajan, " Prestressed Concrete Design", 2024.

REFERENCE BOOKS:

1. Praveen Nagarajan, "Advanced Concrete Design", Person Publishers
2. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York

3. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi
4. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

| PCE104 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 2 | 1 | 2 | - | 3 | 2 | 1 | - | 3 | 2 | 1 | 1 |
| CO2 | - | - | - | - | 1 | 1 | - | 2 | - | - | - | - | 1 | - | 1 | - |
| CO3 | - | 2 | - | 2 | - | 1 | - | - | - | 2 | - | - | 1 | - | 2 | - |
| CO4 | 1 | - | 2 | - | 3 | - | 1 | - | - | - | 3 | 1 | - | 2 | - | - |
| CO5 | 1 | 1 | 2 | - | - | - | 1 | 1 | - | - | - | 1 | 3 | - | - | 1 |
| Average | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 |

OBJECTIVES:

The course prepares

- To develop a solid understanding of the fundamentals of bridge engineering
- To estimate forces and loads acting on bridge structural elements for effective design.
- To design slab and girder beam bridges using appropriate analysis and design methods.
- To design principles and challenges associated with long-span bridges.
- To design substructure components of bridges such as piers and foundation.

9**UNIT-I INTRODUCTION**

Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations, bridge failures.

UNIT-II Loads on Bridges**9**

Indian Road Congress (IRC) bridge codes – dimensions – dead and live loads – impact effect – wind and seismic forces – longitudinal and centrifugal forces – hydraulic forces – earth pressure – temperature effect and secondary stresses.

UNIT-III Slab and T – Beam Bridges**9**

Design of slab bridges – skew slab culverts – box culverts. T – Pigeaud curves – Courbon's theory – Hendry Jaegar method design of T – beam bridges.

UNIT-IV Long Span Bridges**9**

Design Principles of box girder bridges, balanced cantilever bridges, continuous girder bridges, Cable Stayed bridges and Suspension bridges- Design of Prestressed concrete bridges by Courbon's theory (Girder section only) – Design of Steel Concrete composite bridges by Courbons's theory (Girder section only)- Seismic Isolation and damping devices

UNIT-V Bearings and Substructure**9**

Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of Open and deep foundations (well foundation only).

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able to

1. Understand the fundamentals, codes of practice and bridge failures.
2. Understand the estimation of forces for the design bridge structural elements
3. Design of the slab and girder beam bridges using appropriate method
4. Understand the design principles of long span bridges
5. Understand the design of substructure components

TEXT BOOKS:

1. Johnson Victor D., Essentials of Bridge Engineering II, Oxford and IBH Publishing Co., New Delhi, 2021.
2. Rangwala, “ Bridge Engineering”, 2023.
3. D.J. Victor, “Essentials of Bridge Engineering”, 2021.
4. 4. T.R. Jagadeesh and M.A. Jayaram, “ Design of Bridge Structures”, 2020

REFERENCE BOOKS:

1. Phatak D.R., —Bridge Engineering II, Satya Prakashan, New Delhi, 1990.
2. Ponnuswamy S., —Bridge Engineering II, Tata McGraw-Hill, New Delhi, 1996.
3. Rajagopalan. N. —Bridge Superstructure II, Alpha Science International, 2006
4. Design of bridge structures by Jagadeesh and Jayaram, 2nd Edition, PHI Learning, 2009.
5. Design of Bridges, 5th Edition by Raju N.K .Oxford and IBH Publishing Company Pvt.Ltd.

| PCE105 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | - | 2 | 1 | 2 | - | 3 | 2 | 1 | - | 3 | 2 | 1 | 1 |
| CO2 | - | - | - | - | 1 | 1 | - | 2 | - | - | - | - | 1 | - | 1 | - |
| CO3 | - | 2 | - | 2 | - | 1 | - | - | - | 2 | - | - | 1 | - | 2 | - |
| CO4 | 1 | - | 2 | - | 3 | - | 1 | - | - | - | 3 | 1 | - | 2 | - | - |
| CO5 | 1 | 1 | 2 | - | - | - | 1 | 1 | - | - | - | 1 | 3 | - | - | 1 |
| Average | 1.7 | 1.5 | 2.0 | 2.0 | 2.0 | 1.0 | 1.3 | 1.5 | 3.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.3 | 1.0 |

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|---------------|------------------------------|----------|----------|----------|----------|
| PCE106 | INDUSTRIAL STRUCTURES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To learn about planning, layout and functional aspects of industries.
- To design of major steel and R.C structures needed for industries.
- To gain knowledge of prefabrication in Industrial structures.
- To study the requirements, planning and design of steel structures.
- To study the requirements, planning and design of R.C structures

UNIT- I PLANNING 9

Classification of industries and industrial structures – Site Planning and Selection – Exterior and interior Layout for Industries and buildings - Guidelines from factories act.

UNIT- II FUNCTIONAL REQUIREMENTS 9

Lighting – Ventilation – Noise and Vibration control – Fire safety- Codal Provisions.

UNIT- III DESIGN OF STEEL STRUCTURES 9

Pre-engineered buildings - Mill buildings — Power Plant Structures -- Design of Chimney.

UNIT- IV DESIGN OF R.C. STRUCTURES 9

Corbels, Canopy and Nibs - Design of bunkers and silos –Cooling Towers (Principles only).

UNIT- V PREFABRICATION 9

Principles of prefabrication and pre cast construction – Prestressed precast roof trusses – Floor slabs - Wall panels- Handling and erection stresses –joints in precast structures.

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Know the requirements of various industries and get an idea about the materials used and planning of various industrial components.
2. Understand the functional requirements for industrial structures.
3. Design special steel structures like bunkers, silos, power plant structures, chimneys and pre-engineered buildings.
4. Design special RC structures like corbels, Canopy, silos, bunkers, and chimneys.
5. Understand the principles of prefabrication and prestressing.

TEXT BOOKS:

1. Ramachandra and Virendra Gehlot, —Design of steel structuresII Vol. 2, Scientific Publishers, 2015.
2. Ramamrutham.S., —Design of Reinforced Concrete StructuresII, Dhanpat Rai Publishing Company, 2007.
3. Varghese.P.C., —Advanced Reinforced Concrete DesignII, PHI, Eastern Economy Editions, Second Edition, 2005.
4. Subramanian, N., —Design of Steel StructuresII, Oxford University Press, 2016.
5. Ashoke Kumar Dasgupta, “Design of Industrial Structures: Reinforced Cement Concrete and Steel”, 2022.
6. L.S. Jayagopal & D. Tensing, “Design of Steel Structures”, 2015.
7. N. Subramanian, “Design of Steel Structures”, 2016

REFERENCE BOOKS:

1. Henn W., —Buildings for IndustryII, Vol.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP 32–1986, Bureau of Indian Standards, 1990.
3. Handbook of Industrial Lighting, Stanley L.Lyons, Butterworths, London.1981

4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH, 1971.
5. Handbook on Precast Construction, An Indian Concrete Institute Publication, 2016.

| PCE106 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | - | 1 | 1 | - | 2 | 1 | - | - | - | - | 1 | 1 |
| CO2 | 1 | - | 2 | 1 | 3 | 3 | 1 | - | - | - | 2 | 2 | 1 | - | - | 1 |
| CO3 | - | 1 | 3 | 2 | 1 | - | - | - | - | 2 | 1 | - | - | - | 1 | - |
| CO4 | - | - | 2 | 1 | - | 1 | - | - | 2 | - | - | - | - | 1 | - | - |
| CO5 | 1 | - | 2 | - | - | 1 | - | - | - | - | 1 | 2 | - | 1 | - | 1 |
| Average | 1.0 | 1.0 | 2.3 | 1.3 | 2.0 | 1.5 | 1.0 | 0.0 | 2.0 | 1.5 | 1.3 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 |

VERTICAL II : CONSTRUCTION TECHNIQUES AND PRACTICES

| | | | | | |
|---------------|-----------------------------|----------|----------|----------|----------|
| PCE201 | FORMWORK ENGINEERING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To impart the knowledge about detailed planning of form work in construction.
- To impart knowledge on form work materials, accessories, pressures and labour requirement.
- To develop the conceptual understanding of design, construction and erection of form work.
- To impart the knowledge about different types of form work used for special structures.
- To understand the errors in design and judge the form work failures through case studies.

UNIT-I INTRODUCTION TO FORM WORK 9

Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Overall Planning - Detailed planning - Overall programme – Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.

UNIT-II FORMWORK MATERIALS ASSESORIES & PRESSURES 9

Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood – Steel – Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Finish – Sheathing boards working stresses - Repetitive member stress Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls

UNIT-III FORMWORK DESIGN

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

UNIT-IV FORMWORK FOR SPECIAL STRUCTURES 9

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

UNIT-V CASE STUDIES 9

Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. Knowledge on overall and detailed planning of formwork.
2. Apply the knowledge on formwork materials, accessories, pressures and labour requirement.
3. Develop the conceptual understanding of design, construction and erection of formwork.
4. Gain the knowledge about different types of form work used for special structures.
5. Understand the errors in design and judge the formwork failures through case studies.

TEXTBOOKS:

1. Peurify R.L and Oberlender G.D , Formwork for Concrete Structures, , McGraw Hill Education India ,2015
2. Jha K N, Formwork for Concrete Structures, Tata McGraw Hill Education, 2017

3. David W. Johnston., Formwork for Concrete, American Concrete Institute (ACI). 2014.
4. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 2016
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008

REFERENCE BOOKS:

1. Das, B.M. “Principles of Foundation Engineering” (Eighth edition), Thompson Asia Pvt. Ltd., Singapore, 2017.
2. Michael P. Hurst, Construction Press, London and New York, 2012.
3. Christopher Souder , (2014), Temporary Structure Design, Wiley Publications, London
4. David V. Chadderton, Building Services Engineering, Taylor and Francis, 2013.
5. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

| PCE201 | PO | | | | | | | | | | | | PS O | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | | | | | 2 | 2 | | 3 | | 3 | 2 | 3 | | | 3 |
| CO2 | 3 | 3 | 3 | 2 | | | 2 | 1 | 3 | | 2 | 2 | 3 | 3 | 2 | |
| CO3 | 3 | 3 | 3 | 2 | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 2 | 3 | | | | | | | 2 | | 2 | 2 | 3 | | | |
| CO5 | 2 | 1 | 2 | 3 | | | | | 2 | 2 | 3 | 2 | 3 | | | |
| Average | 2.4 | 2.5 | 2.7 | 2.3 | 2.0 | 2.0 | 2.0 | 1.0 | 2.6 | 2.0 | 2.4 | 2.0 | 3.0 | 3.0 | 2.5 | 3.0 |

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|---------------|---|----------|----------|----------|----------|
| PCE202 | CONSTRUCTION EQUIPMENT AND MACHINERY | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To expose the students in the field of construction equipment and machinery so as to gain knowledge in carrying out engineering tasks.
- To learn the fundamentals of earth work operations, earth moving operations and types of earth work equipment
- To understand the knowledge of special construction equipment
- To apply the knowledge on asphalt and concrete plants
- To apply the knowledge and select the proper materials handling equipment

UNIT- I CONSTRUCTION EQUIPMENTS 9

Identification - Planning of equipment - Selection of equipment - Equipment management in projects - Maintenance management - Equipment cost - Operating cost - Cost control of equipment - Depreciation analysis - Replacement analysis - Safety management.

UNIT- II EQUIPMENT FOR EARTHWORK 9

Fundamentals of earthwork operations - Earth moving operations - Types of earthwork equipment - Tractors, motor graders, scrapers, front end loaders - Dozer, excavators, rippers, loaders, trucks and hauling equipment, compacting equipment, finishing equipment - Case studies on earthwork equipment.

UNIT- III OTHER CONSTRUCTION EQUIPMENT 9

Equipment for dredging, trenching, drag line and clam shells, tunneling - Jacking equipment - Equipment for drilling and blasting - Pile driving equipment - Erection equipment - Crane, mobile crane - Types of pumps used in construction - Equipment for dewatering, grouting and demolition.

UNIT- IV ASPHALT AND CONCRETE PLANTS 9

Aggregate production - Different crushers - Feeders - Screening equipment - Handling equipment - Batching and mixing equipment - Ready mix concrete equipment, concrete pumping equipment - Asphalt plant - Asphalt pavers - Asphalt

compacting equipment

UNIT- V MATERIALS HANDLING EQUIPMENT 9

Forklifts and related equipment - Portable material bins - Material handling conveyors – Material handling cranes - Industrial trucks - Aerial transporting equipment

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Develop knowledge on planning of equipment and selection of equipment
2. Gain the knowledge on fundamentals of earth work operations
3. Develop the knowledge on special construction equipment
4. Apply the knowledge on asphalt and concrete plants
5. Apply the knowledge on selection of proper materials handling equipment's used in construction

TEXTBOOKS:

1. Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., Construction Planning, Equipment and Methods, 9th Edn. McGraw Hill, Singapore, 2018
2. Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2020.
3. Deodhar, S.V. Construction Equipment and Job Planning, 4th Edn. Khanna Publishers, New Delhi, 2020.
4. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2019.
5. Dr. Mahesh Varma., Construction Equipment and its Planning and Application, Metro-politan Book Company, New Delhi., 2003

REFERENCE BOOKS:

1. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 2018.

2. Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015
3. Choudhury S, Project Management, McGraw-Hill Publishing Company, New Delhi, 2017.
4. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.
5. Paul Netscher, Construction Project Management: Tips and Insights, Panet Publications, 2017

| PCE202 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |
| CO3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| Average | 2.4 | 2.4 | 2.6 | 2.2 | 2.4 | 2.6 | 2.4 | 2.2 | 2.8 | 2.0 | 2.2 | 2.2 | 2.4 | 2.2 | 2.8 | 2.2 |

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|---------------|---|----------|----------|----------|----------|
| PCE203 | SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials.
- To understand the method of estimating the amount of energy required for building.
- To describe the features of LEED, TERI and GRIHA ratings of buildings.
- To know the core concepts of lean construction tools and techniques and their importance in achieving better productivity.
- To apply lean tools & techniques to achieve sustainability in construction projects.

UNIT- I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

UNIT- II ENERGY CALCULATIONS 9

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy: operational energy in conditioned building - Life Cycle energy use.

UNIT- III GREEN BUILDINGS 9

Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building.

2. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 2013
3. Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2023
4. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2018.
5. New Building Materials and Construction World magazine, 2025

| PCE203 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 1 | 1 | - | 2 | 3 | 1 | 1 | - | 2 | 1 | 3 | 2 | 3 | 2 |
| CO2 | 3 | 1 | 3 | 2 | 1 | 2 | 2 | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |
| CO3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | - | - | - | 3 | 1 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 1 | 3 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 1 | - | 1 | 3 | 2 | 3 | 3 | 3 | 3 |
| Average | 2.6 | 1.3 | 2.4 | 1.6 | 1.5 | 1.6 | 2.4 | 1.0 | 1.0 | 1.0 | 2.4 | 1.6 | 3.0 | 2.6 | 3.0 | 2.6 |

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| PCE204 | CONSTRUCTION, PLANNING AND MANAGEMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To make the students to learn about planning of construction projects, scheduling procedures and techniques.
- To gain the knowledge of cost and quality control projects
- To use project information as decision making tool
- To gain knowledge on quality control
- To develop knowledge on safety measures in construction

UNIT- I CONSTRUCTION PLANNING 9

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Work breakdown structure – Definition Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems

UNIT- II SCHEDULING PROCEDURES AND TECHNIQUES 9

Relevance of construction schedules-Bar charts - The critical path method- Calculations for critical path scheduling and PERT -Activity float and schedules- Presenting project schedules Critical path scheduling for Activity-on-node and with leads, Lags and Windows- Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques- Scheduling with uncertain durations-Calculations for Monte Carlo Schedule Simulation- Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software(Primavera, MS Project)

UNIT- III COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows- Schedule control-Schedule and Budget updates-Relating cost and schedule information.

REFERENCE BOOKS:

1. Moder.J., Phillips. C. and Davis E, "Project Management with CPM, PERT and Precedence Diagramming", Van Nostrand Reinhold Co., 3rd Edition, 2000
2. Saleh Mubarak, "Construction project Scheduling and control", John Wiley and Sons, 2015
3. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 2012.
4. Halpin, D. W., Construction Management, John Wiley & Sons, New York, 2011.
5. Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2020.

| PCE204 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 2 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | - | - | - |
| CO2 | - | - | - | 3 | - | - | 2 | - | - | 3 | - | 3 | - | 2 | - | - |
| CO3 | 3 | - | - | - | - | 3 | - | - | - | - | 2 | 2 | - | | 3 | 2 |
| CO4 | - | 3 | - | - | - | 2 | - | - | 3 | 3 | - | - | - | 3 | - | - |
| CO5 | 2 | - | - | - | 3 | - | - | 2 | - | - | - | - | - | - | 3 | 2 |
| Average | 2.3 | 3.0 | 2.0 | 3.0 | 3.0 | 2.5 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 2.7 | 3.0 | 2.5 | 3.0 | 2.0 |

OBJECTIVES:

- To Understand and explain the goals and principles of green buildings, including certification programs.
- To analyze the objectives of sustainable development, with a focus on evaluating the impact of energy use and carbon emissions in buildings.
- To Compare traditional building techniques and assess their impact on sustainable building practices.
- To explore the use of solar energy in buildings, considering factors like comfort and location.
- To explore green composites and sustainable approaches to water, waste, and sewage management in the built environment.

UNIT- I INTRODUCTION 9

Definitions, Goals, Principles, Features, Requirements and Benefits - Evaluation of Green Buildings - Green Rating Systems - Codes and Certification Programs - Barriers to the Propagation of Green Buildings.

UNIT- II SUSTAINABILITY AND ENERGY USE 9

Sustainability – Objectives of sustainable development – Sustainable principles - Energy use - carbon emissions – Sustainable building materials – LCA - Embodied Energy in Building Materials – Smart Materials - Transportation Energy for Building Materials - Maintenance Energy for Buildings.

UNIT- III IMPLICATIONS OF BUILDING TECHNOLOGIES 9

Traditional Efficient Building techniques - Masonry Construction and Framed Construction - Alternative building concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

UNIT- IV ENERGY SYSTEMS AND PASSIVE SOLAR DESIGN 9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings – Thermal Comfort in Buildings – Building Physics – Daylighting strategies - Issues – Implications of Geographical Locations - Case studies.

UNIT- V GREEN COMPOSITES FOR BUILDINGS

9

Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

1. Understand and apply principles of green buildings and evaluate them using certification programs.
2. Grasp sustainable development goals and propose eco-friendly solutions for energy use in buildings.
3. Compare traditional building techniques, analyze their impact, and suggest sustainable alternatives.
4. Apply knowledge of solar energy for energy-efficient building design, considering comfort and location.
5. Define and apply green composites, proposing sustainable approaches for water, waste, and sewage management.

TEXTBOOKS:

1. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
2. "Low Energy Cooling For Sustainable Buildings". John Wiley and Sons Ltd, 2009.
3. K.S.Jagadish, B. U. Venkatarama Reddy and K. S. Nanjunda Rao.. "Alternative Building Materials and Technologies" New Age International, 2007.
4. "Green Building – Guidebook for sustainable Architecture", Dr. Michael Bauer, Peter mosle, Dr. Micheal Schwarz, Springer, 2007
5. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.

REFERENCE BOOKS:

1. Handbook of Green Building Design and Construction: LEED, BREEAM, and

Green Globes (2nd Edition) by Sam Kubba, 2017.

2. Charles J. Kibert, "Sustainable Construction: Green Building Design and Delivery (5th Edition)" 2020.
3. Fundamentals of Integrated Design for Sustainable Building by Marian Keeler, Bill Burke. Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 2016.
4. Yogi Goswami, Frank Kreith, Energy Efficiency and Renewable energy Handbook, CRC Press, 2016.
5. William E. Browning and William J. D. Looney, "Net Zero Energy Buildings: Perception, Design, and Performance" by Wiley (2015).

| PCE205 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|----------|----------|------------|----------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | 1 | 2 | - | - | - | 3 | - | 2 | 1 | 1 | 2 | - |
| CO2 | 1 | 2 | - | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 1 | - | 2 | - |
| CO3 | 1 | 2 | 2 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 2 | - | 2 | - |
| CO4 | 1 | 2 | 2 | 3 | 2 | 2 | - | - | - | 3 | - | 3 | 1 | 1 | 2 | 1 |
| CO5 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | - | - | 3 | - | 3 | 1 | 1 | 2 | - |
| Average | 1.0 | 2.0 | 2.0 | 2.3 | 1.6 | 2.0 | 3.0 | 0 | 0 | 2.6 | 0 | 2.4 | 1.2 | 1.0 | 2.0 | 1.0 |

| | | | | | |
|---------------|---|----------|----------|----------|----------|
| PCE206 | ADVANCED CONSTRUCTION TECHNIQUES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To study and understand the latest construction techniques applied to engineering construction for sub structure.
- To understanding the principles and concepts relevant to super structure construction for buildings
- To understand the concepts used in the construction of special structures
- To apply the knowledge on Various strengthening and repair methods for different cases
- To identify the suitable demolition technique for demolishing a building

UNIT-I SUB STRUCTURE CONSTRUCTION 9

Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson – sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

UNIT-II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT-III CONSTRUCTION OF SPECIAL STRUCTURES 9

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support

structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT-IV REHABILITATION AND STRENGTHENING TECHNIQUES 9

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

UNIT-V DEMOLITION 9

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Understand the modern construction techniques used in the sub structure construction.
2. Understanding the principles and concepts relevant to super structure construction for buildings.
3. Gain the knowledge about concepts used in the construction of special structures.
4. Knowledge on Various strengthening and repair methods for different cases.
5. Identify the suitable demolition technique for demolishing a building.

TEXTBOOKS:

1. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 2007.
2. Peter H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008.
3. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth Heinemann, Elsevier, New Delhi 2012
4. Prakash, S., and Sharma, H. D., “Pile Foundations in Engineering Practice.” John Wiley & Sons, New York, 1991.

5. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2019

REFERENCE BOOKS:

1. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2000.
2. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.
3. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
4. Hand Book on "Repair and Rehabilitation of RCC Buildings" – Director General works CPWD, Govt of India, New Delhi – 2011.
5. Nayak, N.V., Foundation Design manual for Practicing Engineers, Dhanpat Rai and Sons, 2018.

| PCE206 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | - | 1 | 1 | 2 | 1 | 3 | 2 | 3 | 2 |
| CO2 | 1 | - | - | 2 | 2 | 2 | 3 | - | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 3 |
| CO5 | 1 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| Average | 1.6 | 2.8 | 2.5 | 2.6 | 2.4 | 2.0 | 2.0 | 1.0 | 1.4 | 1.4 | 2.4 | 1.4 | 2.6 | 2.8 | 2.6 | 2.6 |

Fate, and Mitigation" CRC Press, New York, 2001.

3. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.
4. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 2014.
5. Rowe R.K.,"Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2012.

REFERENCE BOOKS:

1. Mohamed,A. M. O.,"Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, New York, 2006.
2. Berkowitz,B. Dror, I. and Yaron,B.,"Contaminant Geochemistry" Springer, Germany, 2014.
3. Bagchi,A.,"Design of landfills and integrated solid waste management" John Wiley & Sons, Inc., USA, 2004
4. Mitchell, J.K.,"Fundamentals of Soil Behavior" Wiley, 2005.
5. Hillel D.,"Introduction to Environmental Soil Physics" Academic Press, New York, 2003.

| PCE301 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | - | - | - | 1 | 3 | 2 | 2 | 3 | 1 |
| CO2 | 3 | 1 | - | - | 2 | 2 | 3 | - | 2 | - | - | 3 | 2 | 2 | 3 | 2 |
| CO3 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | - | - | 1 | 3 | 2 | 2 | 2 | 2 |
| CO4 | 1 | 3 | 3 | 2 | - | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 1 | 2 | 2 | 1 |
| CO5 | 2 | 2 | 3 | 3 | - | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 1 | 2 | 2 | 1 |
| Average | 1.8 | 1.6 | 2.3 | 2.0 | 1.7 | 2.2 | 2.6 | 2.0 | 2.7 | 2.0 | 1.0 | 3.0 | 1.6 | 2.0 | 2.4 | 1.4 |

drainage, separation, erosion control.

UNIT-V CHEMICAL MODIFICATION

9

Grouting – types of grout – suspension and solution grouts – basic requirements of grout - grouting equipment – injection methods – jet grouting – grout monitoring – electro – chemical stabilization – stabilization with cement, lime - stabilization of expansive clay.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Identify and evaluate the deficiencies in the deposits of the given project area and improve its characteristics by hydraulic modifications.
2. Improve the ground characteristics by mechanical modifications using various method and design the system.
3. Improve the ground characteristics by physical modifications using various method and design the system.
4. Improve the characteristics of soils by various reinforcement techniques and design.
5. Analyse the ground and decide the suitable chemical method for improving its characteristics.

TEXTBOOKS:

1. Cox, B.R., and Griffiths S.C., Practical Recommendation for Evaluation and mitigation of Soil Liquefaction in Arkansas, (Project Report), 2010.
2. Day, R.W., Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2010.
3. Rowe, R.K., Geotechnical and Geo-environmental Engineering Handbook, Kluwer Academic Publishers, 2012.
4. Pappala, A.J.,Huang,J., Han, J., and Hoyos, L.R., Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
5. Jewell, R.A., Soil Reinforcement with Geotextiles, CIRIA, London, 1996

REFERENCE BOOKS:

1. Moseley, M.P., Ground Treatment, Blackie Academic and Professionals, 2004.
2. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall 2012.
3. Hehn, R.W., Practical Guide to Grouting of Underground Structures, ASCE, 1996.
4. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.
5. Han,J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015.
6. Manfred R. Hausmann, Engineering Principles of Ground Modifications, McGraw-Hill Publishing Company, New York.1990.

| PCE302 | PO | | | | | | | | | | | | PSO | | | |
|----------------|-----|---|-----|---|-----|-----|-----|-----|-----|-----|-----|----|-----|---|-----|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 2 | 3 | 3 | 1 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 |
| Average | 2.2 | 3 | 2.6 | 2 | 2.2 | 2.4 | 2.2 | 1.4 | 2.2 | 1.6 | 1.2 | 3 | 3 | 3 | 2.8 | 2 |

UNIT-IV DESIGN OF MACHINE FOUNDATION**9**

Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modes of vibration of a rigid foundation – Foundations for reciprocating machines, impact machines, Two – Cylinder vertical compressor, Double-acting steam hammer – Codal recommendations – Empirical approach – Barken's method – Bulb of pressure concept – Pauw's analogy – Vibration table studies.

UNIT-V VIBRATION ISOLATION**9**

Vibration isolation – Types of isolation – Transmissibility – Passive and active isolation – Methods of isolation – Use of springs and damping materials – Properties of isolating materials – Vibration control of existing machine foundation.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. Acquire knowledge to apply theories of vibration to solve dynamic soil problems.
2. Evaluate the dynamic properties of soil using laboratory and field tests.
3. Acquire basic knowledge about machine foundations and design various types of machine foundation.
4. To know and capable of selecting the types of vibration isolation materials.
5. To apply vibration isolation techniques for various field problems.

TEXTBOOKS:

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing, New Delhi, 2002.
2. Prakash, S and Puri, V.K., Foundations for machines, McGraw Hill, 1988.
3. Moore, P.J., Analysis and Design of Foundations for Vibrations, Oxford and IBH, 1985.
4. Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 2017.
5. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia publications

Pvt. Ltd. New Delhi 2016.

REFERENCE BOOKS:

1. Das B.M., Principles of Soil Dynamics, McGraw Hill, 2016.
2. KameswaraRao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi, 1998.
3. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International series, Pearson Education (Singapore) Pvt Ltd, 2024
4. Major, A., Vibration Analysis and Design of Foundations for Machines and Turbines, Vol. I. II and III Budapest, 2011.
5. Arya, S., O'Nelt; S., Design of Structures and Foundations for Vibrating Machines, Prentice Hall, 1981.

| PCE303 | PO | | | | | | | | | | | | PSO | | | |
|----------------|-----|-----|-----|-----|------|-----|---|-----|-----|----|----|----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 3 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | - | - | 3 | 3 | 3 | 3 | 1 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | - | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 3 | 3 | 3 | - | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 |
| Average | 2.2 | 2.6 | 2.4 | 2.6 | 1.75 | 2.6 | 2 | 2.4 | 1.8 | 1 | 1 | 3 | 2.6 | 2.6 | 2.6 | 1.8 |

OBJECTIVES:

The course prepares

- To acquire knowledge on the classification and characteristics of rocks.
- To understand the stress – strain characteristics and failure criteria of rocks.
- To understand and assess the influence of in-situ stress in the stability of various underground excavations.
- To analyze the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations on rocks.
- To understand various methods such as rock reinforcement and rock support to improve the in-situ strength of rocks.

UNIT-I CLASSIFICATION OF ROCKS 9

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

UNIT-II STRENGTH CRITERIA OF ROCKS 9

Behaviour of rock under hydrostatic compression and deviatoric loading - Modes of rock failure planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut-off. Hoek and Brown Strength criteria for rocks with discontinuity sets.

UNIT-III INSITU STRESSES IN ROCKS 9

In-situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks.

UNIT-IV SLOPE STABILITY AND BEARING CAPACITY OF ROCKS 9

Rock slopes - role of discontinuities in slope failure, slope analysis and factor of safety – remedial measures for critical slopes – Bearing capacity of foundations on rocks.

UNIT-V ROCK STABILIZATION

9

Stabilization of rocks - rock support and rock reinforcement-active and passive supports - ground response curve - support reaction curve - reinforcement of fractured and joined rocks - Shotcreting - bolting - anchoring - installation methods.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Classify the Rock mass and rate the quality of rock for tunnelling and foundations works.
2. Understand the shear strength parameters of rocks to design of structures resting on rock and underground excavation in rocks.
3. Apply the knowledge of in-situ stress in the stability of various underground excavations and to design of opening in rocks.
4. Apply the knowledge of slope stability and evaluate slope failures and factor of safety to design foundations on rocks.
5. Improve the in-situ strength of rocks by designing a support system considering the interaction between rock and support.

TEXTBOOKS:

1. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt. Ltd., 2007.
2. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989.
3. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 2005.
4. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K. 2002.
5. Hoek, E and Brown, E.T., Underground Excavations in Rock, Institute of Mining and Metallurgy, U.K. 2017.

REFERENCE BOOKS:

1. Obvert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1996.
2. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John

Wiley and Sons, Chichester, 1985. Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springer-Verlag, Berlin, 1990.

3. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2009.
4. Muni Budhu, Soil Mechanics and Foundation, John Wiley and Sons, INC 2011.
5. Steve Hencher, Practical Rock Mechanics, CRC Press, 2015

| PCE304 | PO | | | | | | | | | | | | PSO | | | |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| Average | 2.6 | 2.6 | 2.8 | 2.2 | 2.4 | 2.6 | 2.2 | 1.8 | 2.4 | 1.4 | 2.6 | 3 | 3 | 2.4 | 2.6 | 2 |

| | | | | | |
|---------------|-----------------------------------|----------|----------|----------|----------|
| PCE305 | EARTH RETAINING STRUCTURES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

The course prepares

- To determine earth pressure acting on the retaining structures.
- To evaluate the various soil parameters influencing the lateral earth pressure.
- To analyse and design flexible earth retaining walls and anchor systems.
- To understand the basic design concepts of supported excavations.
- To understand to characteristics and specification of slurry in supported systems.

UNIT-I EARTH PRESSURE THEORIES 9

Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann’s method) – Active and passive cases – Earth pressure due to external loads.

UNIT-II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES 9

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT-III SHEET PILE WALLS 9

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT-IV SUPPORTED EXCAVATIONS 9

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

UNIT-V SLURRY SUPPORTED EXCAVATION

9

Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm wallsbored pile walls-contiguous pile wall-secant piles-stability analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Apply earth pressure theories to design retaining structures considering all parameters affecting the total earth pressure.
2. Understand the effect of compaction, wall flexibility, pore water pressure and earthquake forces on rigid retaining structures.
3. Apply the knowledge of earth pressure in designing retaining walls and anchors.
4. Designing of braced excavations, slurry supported excavations and underground utilities.
5. Perform stability analysis for slurry supported excavations.

TEXTBOOKS:

1. Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, The PWS series in Civil Engineering, 2022.
2. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2012.
3. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge,2014.
4. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, Second Edition, Survey University Press, 2014.
5. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, Galgotia Book source, 2010.

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1. Mandal, J.N., Reinforced Soil and Geotextiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2005.
2. Day, R.W., Geotechnical and Foundation Engineering: Design and Construction, McGraw Hill, 2020.

3. Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 2012.
4. McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2018.
5. Hajnal, I., Marton, J. and Regele, Z., Construction of diaphragm walls, A Wiley – Interscience Publication, 1984.
6. Petros P. Xanthakos., Slurry walls as structural systems, McGraw-Hill, Inc., New York, 1994.
7. Bramhead, E.N., The Stability of Slopes, Blacky Academic and Professionals Publications, Glasgow, 1992.

| PCE305 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|----------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | - | 2 | 2 | 1 | 2 | 2 | 3 |
| Average | 2.6 | 2.2 | 2.8 | 2.4 | 2.8 | 2.4 | 1.6 | 1.8 | 1.8 | 2 | 2.8 | 2.8 | 2.2 | 2.4 | 2.4 | 2.2 |

OBJECTIVES:

The course prepares

- To gain familiarity with different types of foundation.
- To expose the students to the design of shallow foundations and deep foundations.
- To familiarize the students for the geotechnical design of pile foundations.
- To understand the concepts in designing well, machine and special foundations.
- To plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation.

UNIT-I SHALLOW FOUNDATIONS 9

Soil investigation - Basic requirements of foundation - Types and selection of foundations. Bearing capacity of soil - plate load test - Design of reinforced concrete isolated, strip, combined and strap footings - mat foundation.

UNIT-II PILE FOUNDATIONS 9

Introduction – Types of pile foundations – load carrying capacity - pile load test –pile driving and construction–configuration of piles- different shapes of piles cap – structural design of pile cap – Under-reamed pile foundation.

UNIT-III WELL FOUNDATIONS 9

Types of well foundation – Grip length – load carrying capacity – construction of wells – Design aspects – Failures and Remedies – Design principles of well foundation – Lateral stability.

UNIT-IV MACHINE FOUNDATIONS 9

Introduction – Fundamental aspects of Vibration - Fundamentals of Soil Dynamics - Types of machine foundation – Basic principles of design of machine foundation – Codal Provisions - Design of foundation for Reciprocating machines and Impact machines – Vibration isolation - Construction aspects

UNIT-V SPECIAL FOUNDATIONS

9

Foundation on expansive soils – choice of foundation – Foundation for concrete Towers and chimneys – Reinforced earth retaining walls - Marine Foundations.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. On completion of this course students will be able to select appropriate foundation type based on available soil conditions.
2. They will be in a position to determine the load carrying capacity of deep foundation.
3. Design the well foundations for construction engineering structures.
4. Understand the theory of vibrations and Design the well foundations for construction Engineering structures.
5. Analyze the soil foundation on expansive soils and to design foundation for special structures.

TEXTBOOKS:

1. Varghese.P.C, Design of Reinforced Concrete Foundations, –PHI learning private limited, New Delhi –2009.
2. Bowles .J.E., Foundation Analysis and Design, McGrawHill Publishing co.,New York,1997.
3. Swamy Saran, Analysis and Design of substructures, Oxford and IBH Publishing Co. Pvt. Ltd.,2018.
4. Tomlinson.M.J, Foundation Design and Construction,Longman,Sixth Edition,New Delhi, 2001.
5. S. Saram, Analysis and Design of Substructures - Limit State Design, Oxford and IBH Publishing, 2018.

REFERENCE BOOKS:

1. Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 2008.

2. Michael T and John W, Pile design and Construction Practice, CRC Press, London, 2020.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 2019.
4. Major, A., Vibration Analysis and Design of Foundations for Machines and Turbines, Vol. I. II and III Budapest, 1964.
5. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 2019.

| PCE306 | PO | | | | | | | | | | | | PSO | | | |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 3 | 2 | - | 3 | - | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | - | 2 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 1 | 3 | 1 | 2 | - | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 2 | 2 | - | 1 | 3 | 2 | 1 | 2 | 3 | - | 2 | 2 | 2 | 3 | 2 | 2 |
| Average | 2.4 | 2.0 | 1.8 | 1.8 | 2.4 | 1.8 | 2.2 | 1.7 | 1.8 | 1.8 | 1.8 | 2.0 | 2.3 | 2.4 | 2.2 | 2.0 |

facilities & cycle tracks.

UNIT- IV TRAFFIC SAFETY AND ENVIRONMENT 9

Road accidents – Causes, effects and prevention – Street lighting – Traffic and environment hazards – Air and Noise Pollution - causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

UNIT- V TRAFFIC MANAGEMENT 9

Area Traffic Management System - Traffic System Management (TSM) with IRC standards -- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Interpret the fundamentals of traffic characteristics and land use modelling
- Applications of traffic survey and studies with Level of Service.
- Design traffic signal and intersections
- Control road accidents and promote public transport system.
- Perceive Traffic system management techniques and operations

TEXTBOOKS:

1. Kadiyali, L.R., “Traffic Engineering and Transport Planning”, 9th Edition, Khanna Publishers, Delhi, 2024.
2. Saxena S.C, “Textbook of Highway and Traffic Engineering”, CBS Publishers and Distribution Private Limited. 2020
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

4. SP:43-2014, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 2014
5. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", 2nd Edition, Macmillan Press Ltd, 2019.
6. AASHTO, A Policy on Geometric Design of Highway and Streets.

REFERENCE BOOKS:

1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2021
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2020.
3. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesley Publishing Company, 2022.
4. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2019
5. Khanna.K, Justo.C.E.G. and Veeraragavan A "Highway Engineering", 10th edition, Nem Chand & Bros Publishers, 2019.

| PCE401 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 | - |
| CO2 | 2 | - | 3 | 1 | - | - | 2 | 2 | - | - | 3 | - | - | - | 2 | 3 |
| CO3 | 3 | 1 | - | 3 | - | 2 | - | - | - | 2 | - | - | - | 2 | 3 | - |
| CO4 | - | - | 3 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 2 | 3 | - | - |
| CO5 | 3 | - | - | 2 | - | - | 3 | - | 1 | - | - | 2 | - | 1 | 2 | 3 |
| Average | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |

UNIT- IV PLANNING AND DESIGN OF URBAN DEVELOPMENT 9
PROJECTS

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT- V LEGISLATION, DEVELOPMENT AND MANAGEMENT OF 9
URBAN SYSTEM

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Describe basic issues in urban planning
2. Formulate plans for urban and rural development.
3. Plan and analyses socio-economic aspects of urban and rural areas.
4. Formulation of urban development projects.
5. Legal requirements for managing urban development projects.

TEXTBOOKS:

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2020.
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 2021.
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2021.
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 2020.
5. A K Jain, “Town Planning”, Khanna Publishing House, 1st Edition, 2020.

REFERENCE BOOKS:

1. Thooyavan. K.R, "Human Settlements – A Planning Guide to Beginners. M.A Publications, Chennai 2020.
2. CMDA 2018, "Combined Development Regulation of Building Rules 2018", CMDA, Chennai.
3. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai.
4. CMDA, Second Master Plan for Chennai, Chennai 2008.
5. Mintesnot G. Woldeamanuel , "Urban Issues in Rapidly Growing Cities: Planning for Development in Addis Ababa (Routledge Contemporary Africa)", 2020

| PCE402 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 3 | 1 | 3 | 1 | 1 | 1 | 3 | 3 | - | - | 3 | 3 | 1 | 1 |
| CO2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | - |
| CO3 | - | - | 3 | - | - | - | - | - | 2 | - | - | - | 3 | 2 | - | - |
| CO4 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 2 | 1 | - |
| Average | 2.8 | 2.0 | 2.6 | 1.5 | 2.5 | 1.3 | 1.0 | 1.0 | 2.6 | 2.0 | 1.7 | 2.0 | 2.8 | 2.0 | 1.3 | 1.0 |

PCE403

SMART CITIES

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

OBJECTIVES:

- To make students aware on the changing scenario in the cities and regions
- To gain knowledge on infrastructure requirements in smart cities.
- To understand the needs and demand of sustainability of smart cities.
- To apply the advanced technology in smart city conversion.
- To understand fundamentals of project management in smart cities.

UNIT- I INTRODUCTION 9

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission

UNIT- II SMART PHYSICAL INFRASTRUCTURE 9

Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc

UNIT- III SUSTAINABILITY AND SMART PLANNING 9

Relationship Between Sustainability and Smart planning - Place making project guidelinesSurveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services;

UNIT- IV APPLICATION OF TECHNOLOGIES IN SMART CITIES 9

Role of Technologies in Smart Cities – Internet of Things - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities – Smart governance platform.

UNIT- V SMART CITIES PROJECT MANAGEMENT

9

Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Understand the basics of Urbanization and the role of smart cities
- Gain knowledge on implementation of smart physical infrastructure.
- Understand the role of smart planning for sustainable development.
- Comprehend the knowledge of Technologies in Smart City planning
- Reviewing the case studies of smart city projects.

TEXTBOOKS:

1. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2021
2. Sameer Sharma, “Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.
3. . Binti Singh, Manoj Parmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory Routledge India,2019
4. Brkovic, M. B., ‘Planning in the Information Age: Opportunities and Challenges of e-Planning, CORP, 2021
5. Intelligent Community forum, ‘Innovation and Employment in the Intelligent Community”, Intelligent Community forum, 2021

REFERENCE BOOKS:

1. City Government of Naga, ‘The Naga City Citizen Chartes- A Guide Book of City Government Services. 2011
2. Elizabeth, S. Frans, V. ‘IDENSITY: Planning Paradigms for the Information

Communication Age', Isocarp Congress, 2021.

3. Komakech, D., 'Achieving More Intelligent Cities", Municipal Engineer, 2018.
4. <https://smartcities.gov.in/guidelines#block-habikon-content>
5. <https://smartnet.niua.org/learn/library>

| PCE403 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 | - |
| CO2 | 2 | - | 3 | 1 | - | - | 2 | 2 | - | - | 3 | - | - | - | 2 | 3 |
| CO3 | 3 | 1 | - | 3 | - | 2 | - | - | - | 2 | - | - | - | 2 | 3 | - |
| CO4 | - | - | 3 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 2 | 3 | - | - |
| CO5 | 3 | - | - | 2 | - | - | 3 | - | 1 | - | - | 2 | - | 1 | 2 | 3 |
| Average | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |

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| PCE404 | INTELLIGENT TRANSPORT SYSTEMS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the fundamentals of ITS.
- To understand various data collection tools in ITS.
- To study the ITS application in traffic management.
- To understand the role of ITS in Transportation planning.
- To understand the role of ITS in Fleet management system.

UNIT- I INTRODUCTION TO ITS 9

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment. Benefits of ITS- Overview of application of ITS in Transportation Planning

UNIT- II DATA COLLECTION THROUGH ITS 9

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)

UNIT- III ITS IN TRAFFIC MANAGEMENT 9

ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

UNIT- IV ITS IN TRANSPORTATION PLANNING 9

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS

and road-pricing.; Transportation network operations – public transportation applications- Weight –in Motion

UNIT- V ITS APPLICATION IN LOGISTICS 9

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Understand the fundamentals of ITS and its benefits.
- Gain knowledge on data collection using sensors and its applications.
- Acquainted with the knowledge of ITS in Traffic Management
- Application of ITS in Transportation Planning
- Able to gain knowledge on application of ITS in Logistics

TEXTBOOKS:

1. R. Srinivasa Kumar, "Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.
2. Pradeep Kumar Sarkar and A K Jain, "Intelligent Transport Systems", PHI Learning, Eastern Economy Edition, 2018.
3. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2021.
4. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 2020.
5. TurbanE."Decision Support and Export Systems Management Support Systems", Maxwell Macmillan, 2018.
6. Ghosh, S., Lee, T.S. Intelligent Transportation Systems: New Principles and Architectures, CRC Press, 2020.

REFERENCE BOOKS:

1. Sitausu S. Mitra, "Decision Support Systems–Tools and Techniques", John Wiley, New York, 2021.
2. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application“, Springer Verlag, New York, 2017
3. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
4. Sussman, J.M. Perspectives on Intelligent Transportation Systems, Springer, Berlin, 2020.
5. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2018.

| PCE404 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 3 | 3 | - | - | 3 | 3 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 3 | 2 | - | 1 |
| CO3 | - | - | 3 | - | - | - | - | - | 2 | - | - | - | 3 | 2 | - | - |
| CO4 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 2 | 1 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 2 | 1 | - |
| Average | 3.0 | 2.5 | 2.6 | 2.0 | 2.8 | 1.3 | 1.0 | 1.0 | 2.6 | 2.0 | 1.7 | 2.0 | 2.8 | 2.4 | 1.3 | 1.0 |

PCE405

PAVEMENT ENGINEERING

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

OBJECTIVES:

- To study the pavement materials and types.
- To design a flexible pavements
- To design a rigid pavements
- To study the construction and maintenance of both flexible and rigid pavements.
- To understand the stabilization and control pavement failures.

UNIT- I PAVEMENT MATERIALS AND SUBGRADE ANALYSIS 9

Introduction – Pavement as layered structure – Pavement types -rigid and flexible- Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

UNIT- II DESIGN OF FLEXIBLE PAVEMENTS 9

Flexible pavement design – Advantages and disadvantages -Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

UNIT- III DESIGN OF RIGID PAVEMENTS 9

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 9

Construction Techniques practice of flexible and concrete pavement 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

9

Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Get knowledge about types of rigid and flexible pavements.
- Able to design of rigid pavements
- Able to design of flexible pavements.
- Determine the causes of distress in rigid and flexible pavements.
- Understand stabilization of pavements, testing and field control.

TEXTBOOKS:

1. Sandipan Goswami, “Pavement Engineering: Design”, PHI Learning, Eastern Economy Edition, 2022.
2. Rajib B. Mallick and Tahar El-Korchi, “Pavement Engineering: Principles and Practice”, 4th Edition, CRC Press, 2022.
3. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition, 2019.
4. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khannatech. Publications, New Delhi,2019.
5. Dimitriou H.T, Urban Transport Planning, A Development Approach, Routledge, London, 2022

REFERENCE BOOKS:

1. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37–2018, The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-2018, The Indian Road Congress, New Delhi.
4. Yoder, E.J., and Witczak, Principles of Pavement Design, 2nd John Wiley and Sons, 2021.
5. Yang Huang, Pavement Analysis and Design, Pearson, 2019.

| PCE405 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 | - |
| CO2 | 2 | - | 3 | 1 | - | - | 2 | 2 | - | - | 3 | - | - | - | 2 | 3 |
| CO3 | 3 | 1 | - | 3 | - | 2 | - | - | - | 2 | - | - | - | 2 | 3 | - |
| CO4 | - | - | 3 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 2 | 3 | - | - |
| CO5 | 3 | - | - | 2 | - | - | 3 | - | 1 | - | - | 2 | - | 1 | 2 | 3 |
| Average | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |

UNIT- IV MODAL SPLIT STAGE 9

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model

UNIT- V TRAFFIC ASSIGNMENT STAGE 9

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Understand the principles of the transportation planning process and methods of data collection.
- Acquainted with the trip production, trip attraction models and calibration.
- Able to understand trip distribution models and its application.
- Gain knowledge on the mode choice behavior and modal split models.
- Gain knowledge on route assignment and future developments.

TEXTBOOKS:

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2024.
2. Pradeep Kumar Sarkar, Vinay Maitri and G J Joshi, "Transportation Planning: Principles, Practices and Policies, 3rd Edition, PHI Learning, Eastern Economy Edition.
3. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2019.
4. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 2021.

- Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.

REFERENCE BOOKS:

- J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York, 2018.
- John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2020.
- C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 2019
- Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons, 2021.
- James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2019.

| PCE406 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 | - |
| CO2 | 2 | - | 3 | 1 | - | - | 2 | 2 | - | - | 3 | - | - | - | 2 | 3 |
| CO3 | 3 | 1 | - | 3 | - | 2 | - | - | - | 2 | - | - | - | 2 | 3 | - |
| CO4 | - | - | 3 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | 2 | 3 | - | - |
| CO5 | 3 | - | - | 2 | - | - | 3 | - | 1 | - | - | 2 | - | 1 | 2 | 3 |
| Average | 2.8 | 1.0 | 3.0 | 2.2 | 1.0 | 2.0 | 2.5 | 1.5 | 1.0 | 2.0 | 3.0 | 2.0 | 2.5 | 2.0 | 2.0 | 3.0 |

UNIT- IV OBSERVED CHANGES AND ITS CAUSES**9**

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC– IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT- V CLIMATE CHANGE AND MITIGATION MEASURES**9**

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. To demonstrate an understanding of how the threats and opportunities of predicted climate change will influence specific sectors at global and regional scale.
2. To critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts
3. To understand the scientific insights underlying the assessment reports of the IPCC.
4. To critically evaluate with a focus on impacts, adaptation and mitigation.
5. To analyse different climate change scenarios and their implications.

TEXTBOOKS:

1. Nugegoda Golam Kibria, A. K. Yousuf Haroon, Dayanthi, "Climate Change and Water Security: Impacts, Future Scenarios, Adaptations and Mitigations", New India Publishing Agency, 2016.
2. Dash Sushil Kumar, Climate Change – An Indian Perspective, Cambridge University Press India Pvt. Ltd, 2007.
3. Sumi A, Fukushi K, Hiramatsu A, "Adaptation and Mitigation Strategies for Climate Change" Springer.
4. Mark Maslin, Global Warming- A very short introduction, Oxford publication,2009.
5. John Oliver & John Hidore, Climatology-An Atmospheric Science (second edition) – Indian edition, Pearson Education India,2003.

REFERENCE BOOKS:

1. Baharak Sajjadi , Maximilian Lackner , Wei-Yin Chen , "Handbook of Climate Change Mitigation and Adaptation", 3rd ed. 2022, Springer Nature Switzerland AG.
2. Lisa Dale, "Climate Change Adaptation", Columbia University Press, 2022.
3. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.
4. John Theodore Houghton , "Global Warming: the complete briefing", 5th Edition,Cambridge University Press,2015.
5. Jonathan Cowie, "Climate change: Biological and Human Aspects", 2nd Edition,Cambridge University Press,2013.

| PCE501 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - | - | 2 | 1 | - |
| CO2 | - | - | - | - | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 2 | 1 |
| CO3 | - | 2 | - | - | 2 | 2 | 2 | - | - | - | - | 2 | 2 | - | 2 | 1 |
| CO4 | - | 2 | - | 2 | - | 1 | 1 | - | - | - | - | 2 | 2 | - | 1 | 2 |
| CO5 | 2 | 2 | 1 | 2 | - | 2 | 2 | - | - | - | - | 2 | 2 | 1 | 2 | 2 |
| Average | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.8 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 1.5 | 1.6 | 1.5 |

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|---------------|----------------------------------|----------|----------|----------|----------|
| PCE502 | AIR POLLUTION AND CONTROL | L | T | P | C |
| | ENGINEERING | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
- To create awareness among the sources and effects of air pollution.
- To gain knowledge on air pollution control equipments.
- To develop a knowledge on air quality standards.
- To gain knowledge of characteristics of air pollution and noise pollution.

UNIT- I INTRODUCTION 9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution –Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards - Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT- II METEOROLOGY 9

Effects of Meteorology on Air pollution-Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns-Atmospheric Diffusion Theories-Dispersion models, plume rise.

UNIT- III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT- IV CONTROL OF GASEOUS CONTAMINANTS**9**

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT- V INDOOR AIR QUALITY MANAGEMENT**9**

Air quality standards - Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness - Town planning regulations of industries-Sources and Effects of Noise Pollution – Measurement – Standards – Control and Preventive measures.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

- An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- Ability to identify, formulate and solve air and noise pollution problems
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipments.
- Ability to ensure quality, control and preventive measures.

TEXTBOOKS:

1. C.S. Rao “Environmental Pollution Control Engineering” 4th Edition (2022), New Age International Publishers.
2. S.C. Bhatia “Textbook of Noise Pollution and Its Control” Edition: 2023, Atlantic Publishers and Distributors.
3. Noel de Nevers, “Air Pollution Control Engineering” (Third Edition), Waveland press, Inc 2017.

4. Daniel Vallero, Fundamentals of Air Pollution, 2014, Fifth Edition, Elsevier's Science & Technology, Academic Press, USA.
5. Enda Murphy, Eoin A. King, Environmental Noise Pollution: Noise Mapping, Public Health, and Policy, 2014, First Edition, Elsevier's Science & Technology, USA.

REFERENCE BOOKS:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2018.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)",(Third Edition) Academic Press, 2013.
3. Wayne T. Davis, Joshua S. Fu, Thad Godish, Air Quality, 2021, Sixth Edition, CRC Press, USA.
4. Malcolm J. Crocker, Handbook of Noise and Vibration Control, 2007, John Willey and Sons Inc., USA
5. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited, 2007.

| PCE502 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | - | 1 | - | - | 1 | 1 | 2 | - | 1 | 2 | 1 | - |
| CO2 | - | - | 2 | 3 | - | - | 3 | 2 | 2 | - | - | 3 | - | - | - | 1 |
| CO3 | 1 | 2 | 3 | - | - | 2 | 2 | 3 | - | 2 | - | - | 3 | - | - | - |
| CO4 | - | 2 | - | 3 | - | - | - | - | 2 | 2 | - | 2 | - | 2 | 1 | - |
| CO5 | 1 | 1 | 2 | 3 | - | 1 | 3 | 3 | 1 | 1 | 2 | 3 | 2 | - | 2 | - |
| Average | 1.0 | 1.7 | 2.3 | 3.0 | 0.0 | 1.3 | 2.7 | 2.7 | 1.5 | 1.5 | 2.0 | 2.7 | 2.0 | 2.0 | 1.3 | 1.0 |

| | | | | | |
|---------------|------------------------------------|----------|----------|----------|----------|
| PCE503 | ENVIRONMENTAL SOCIAL IMPACT | L | T | P | C |
| | METHODOLOGY AND ASSESSMENT | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To develop a comprehensive understanding of sustainable development concepts, the EIA process, and stakeholders' roles.
- To acquire skills in EIA procedure, baseline monitoring, and impact assessment for land, water, air, noise, and energy.
- To evaluate policy and legal aspects, and formulate effective EMPs with mitigation strategies.
- Gain proficiency in environmental auditing and review of EIA reports for clearance.
- To analyze rehabilitation plans, and explore economic aspects, including valuation and ecological economics.

UNIT- I INTRODUCTION 9

Basic concepts - Impacts of Development on Environment – Rio Principles of Sustainable Development Environmental Impact Assessment (EIA) – Historical development – EIA in project cycle – EIA Notification and Legal Framework – Stakeholders and their Role in EIA.

UNIT- II EIA METHODOLOGIES 9

LCA - EIA Procedure - Baseline monitoring - Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna – EIA Methods.

UNIT- III ENVIRONMENTAL MANAGEMENT PLAN 9

Policy and Legal Aspects of EMP - Environmental Policies and Programmes in India - Environmental Laws and Legislations - Environmental Monitoring Plan - Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna.

UNIT- IV ENVIRONMENTAL MITIGATIONS AND ECONOMICS 9

Rehabilitation and Resettlement Plan - National Rehabilitation and Resettlement Policy - Economics and the Environment - Environmental Valuation - Economics of Natural Resources - Ecological Economics

UNIT- V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Multi-storey Buildings Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Power plants – Water supply and drainage projects- Waste water treatment plants, STP – Mining Projects

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

- Understand sustainable development, articulate EIA processes, and analyze stakeholder roles.
- Proficient in EIA procedures, baseline monitoring, and impact assessment methodologies.
- Evaluate policies, formulate effective EMPs, and integrate mitigation strategies.
- Master environmental auditing, ensuring compliance and sustainability through critical reviews.
- Analyze rehabilitation plans, integrate economic principles for sustainable decision-making.

TEXT BOOKS:

1. Rachna Bhateria, Mona Sharma, Rimmy Singh, Sumit Kumar, “Environmental Impact Assessment: A Journey to Sustainable Development”, Springer Nature,2024

2. V.S. Kulkarni, S.N. Kaul, R.K. Trivedy, "A Handbook of Environmental Impact Assessment", Scientific Publishers, 2024.
3. B.B. Hosetti, Arvind Kumar, "Environmental Impact Assessment and Management", Daya Publishing House, 2024.
4. Canter, R.L, "Environmental impact Assessment", 2nd Edition, McGraw Hill Inc, New Delhi, 1995.
5. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.

REFERENCE BOOKS:

1. Becker H. A., Frank Vanclay , "The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1999.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.
5. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, 2009.

| PCE503 | PROGRAM OUTCOMES | | | | | | | | | | | | PSO | | | |
|----------------|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 2 | - | - | - | 2 | - | 2 | - | 3 | - | 2 | 1 | - | - | 1 |
| CO2 | - | 1 | - | 2 | - | 2 | - | 2 | - | 2 | - | 2 | 1 | - | - | 1 |
| CO3 | - | - | 2 | 2 | - | 2 | - | 2 | - | 2 | - | 2 | - | 2 | - | 1 |
| CO4 | - | - | 2 | 3 | - | 2 | - | 3 | - | 3 | - | 3 | 1 | 1 | - | 1 |
| CO5 | - | - | 2 | 2 | - | 2 | 3 | 2 | - | 3 | - | 3 | - | 1 | - | 1 |
| Average | 1.0 | 1.5 | 2.0 | 2.3 | 0.0 | 2.0 | 3.0 | 2.2 | 0.0 | 2.6 | 0.0 | 2.4 | 1.0 | 1.3 | 0.0 | 1.0 |

UNIT- III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 9

Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation -density separation - magnetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

UNIT- IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 9

Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

UNIT- V WASTE DISPOSAL 9

Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders
- Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes, assess the factors affecting variation and assess performance of waste treatment and disposal systems.
- Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.
- Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context.
- Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning.

TEXTBOOKS:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.
2. CPHEEO, "Manual on Municipal Solid waste management, Vol I, II and III, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.
3. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering – A Globalerspective, 3rd Edition, Cengage Learning, 2017.
4. M. N. Rao , Razia Sultana , "Solid and Hazardous Waste Management", Second Edition, B.S Publication, 2020.
5. Iqbal H. Khan , Naved Ahsan, "Textbook of Solid Wastes Management" First Edition, Kindle Edition, 2017.

REFERENCE BOOKS:

1. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York,2010.
2. John Pichtel,Waste Management Practices, CRC Press, Taylor and Francis Group,2014.
3. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010
4. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.
5. Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering , Butterworth-Heinemann, 2016.

| PCE504 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 2 | - | 1 | - | 3 | - | 2 | - | - | - | 2 | 2 | 1 | 1 |
| CO2 | 1 | - | - | - | 2 | - | 1 | - | 3 | 2 | - | - | 3 | 2 | - | 1 |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | 1 | 2 | - | - | 3 | 1 | 2 | 2 |
| CO4 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 2 | - |
| CO5 | 2 | 2 | - | 2 | 2 | - | 2 | - | 2 | - | - | - | 1 | - | - | - |
| Average | 1.8 | 2.5 | 2.0 | 2.0 | 1.8 | 0.0 | 2.0 | 0.0 | 2.0 | 2.0 | 0.0 | 0.0 | 2.3 | 1.7 | 1.7 | 1.3 |

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|---------------|------------------------------------|----------|----------|----------|----------|
| PCE505 | ENVIRONMENT AND AGRICULTURE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.
- To understand the ecological context of agriculture and its concerns.
- To study the context of climate change and emerging global issues.
- To introduce the students about the importance of the land and water resources in India.
- To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.

UNIT- I ENVIRONMENTAL CONCERNS 9

Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Disaster management. Floods, earthquakes, cyclones and landslides. Social issues and the environment, unsustainable to sustainable development. The Environment Protections Act, The Air Act, The water Act, The Wildlife Protection

UNIT- II LIFE CYCLE ASSESSMENT 9

Introduction to Life Cycle Thinking - analytical tools for product and service systems – History and definition of LCA - International organizations and networks - Life cycle of Products and services – Industrial ecology - Impacts & value creation along the life cycle – Life cycle management (LCM) and Stakeholder Expectations – Life cycle goal and scope definition - function, functional unit.

UNIT- III CLIMATE CHANGE AND ECOLOGICAL DIVERSITY 9

Global warming and changing environment – Ecosystem changes – Changing blue green-grey water cycles – Water scarcity and water shortages – Desertification- Ecological diversity, wild life and agriculture – GM crops and their impacts on the

2005.

3. B.K.Desai and Pujari, B.T., “Sustainable Agriculture: A vision for future”, New India Publishing Agency, New Delhi, 2007.
4. Saroja Raman, “Agricultural Sustainability – Principles, Processes and Prospects”, CRC Press, 2013.
5. Prof Johannes S. C. Wiskerke, Dr Nevin Cohen, Dr Laine Young, Prof Alison Blay-Palmer, Achieving sustainable urban agriculture, 2020.

REFERENCE BOOKS:

1. T.C. Byerly, Environment and Agriculture, United States Dept. of Agriculture, Economic Research Service, 2006.
2. Robert D. Havener, Steven A. Breth, Environment and agriculture: rethinking development issues for the 21st century: proceedings of a symposium, Winrock International Institute for Agricultural Development, 1994.
3. Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989.
4. Marry Ann Curan, Environment Life Cycle Assessment, Mc Graw Hill New York 1996.
5. Bhoopander Giri, Ram Prasad, Qiang-Sheng Wu, Ajit Varma, Biofertilizers for Sustainable Agriculture and Environment, 2019.

| PCE505 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | - | - | - | 1 | 1 | - | - | 1 | - | - | 2 | 2 | 1 | 1 |
| CO2 | 2 | 3 | 1 | - | 2 | 3 | - | - | 1 | - | 1 | 1 | 1 | 1 | 1 | 2 |
| CO3 | 1 | 3 | - | - | - | 1 | 2 | - | - | - | - | 2 | 2 | 2 | 2 | 1 |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | 3 | 2 | 1 | - | 2 | 3 | 2 | 1 | 1 | - |
| CO5 | - | 3 | 2 | 2 | 3 | - | 3 | 3 | - | - | 2 | 3 | 2 | 2 | 3 | 1 |
| Average | 2.0 | 2.8 | 2.0 | 2.0 | 2.7 | 1.7 | 2.3 | 2.5 | 1.0 | 1.0 | 1.7 | 2.3 | 1.8 | 1.6 | 1.6 | 1.3 |

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|---------------|---------------------------------------|----------|----------|----------|----------|
| PCE506 | ENVIRONMENT, HEALTH AND SAFETY | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To know overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System.
- To educate the students the health hazards expected and the safety measures to be followed in the industry.
- To gain a basic understanding of the workplace safety and safety systems and an in depth knowledge of the safety technologies.
- To gain deep understanding of the safety audits and how they are implemented.
- To have basic knowledge of how the humans are affected and their management methodologies.

UNIT- I INTRODUCTION 9

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT- II OCCUPATIONAL HEALTH AND HYGIENE 9

Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria.

2. Prof. Sunil S.Rao , R.K.Jain Industrial Safety, Health and Environment Management Systems, Khanna Publishers,2000.
3. Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India,2007.
4. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012.
5. R.K. Jain, Sunil S. Rao, "Industrial Safety, Health and Environment Management Systems".

REFERENCE BOOKS:

1. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.
2. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995.
3. Slote. L, Handbook of Occupational Safety and Health, John Willey and Sons, NewYork.
4. Pallavi Saxena, Anju Srivastava, Air Pollution and Environmental Health, Publisher Springer, 2020.
5. Alston Frances , "Guide to Environment Safety and Health Management", Taylor & Francis Ltd.

| PCE506 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 2 | - | 1 | - | 3 | - | 2 | - | - | - | 3 | 2 | 2 | 3 |
| CO2 | 2 | - | - | - | 2 | - | 1 | - | 3 | 2 | - | - | 2 | 2 | 3 | 2 |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | 2 | 2 | - | - | 2 | 1 | 3 | 2 |
| CO4 | 2 | - | 2 | 3 | 2 | - | - | - | 2 | - | - | - | 2 | - | 2 | 1 |
| CO5 | 2 | 2 | - | - | 2 | - | 2 | - | 3 | - | - | - | 3 | 2 | - | 1 |
| Average | 2.0 | 2.5 | 2.0 | 3.0 | 1.8 | 0.0 | 2.0 | 0.0 | 2.4 | 2.0 | 0.0 | 0.0 | 2.4 | 1.8 | 2.5 | 1.8 |

irrigation, industrial sectors - modernization techniques – Rehabilitation – Command Area Development - Water delivery systems

UNIT- IV PARTICIPATORY WATER CONSERVATION 9

Global Challenges -Social – Economic – Environmental - Solutions –Political - Water Marketing – Water Rights -Consumer education – Success Stories Case Studies

UNIT- V PARTICIPATORY WATERSHED DEVELOPMENT 9

Concept and significance of watershed - Basic factors influencing watershed development -- Principles of watershed management - Definition of watershed management – Identification of problems - Watershed approach in Government programmes -- People’s participation – Entry point activities - Evaluation of watershed management measures.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Gain knowledge on various processes involved in participatory water resource management.
2. Understand farmers participation in water resources management.
3. Aware of the issues related to water conservation and watershed Development.
4. Get knowledge in participatory water conservation
5. Understand concept, principle, approach of watershed management.

TEXTBOOKS:

1. Iqbal.Mujtaba, Thokozani Majozi , Mutiu Kolade Amosa ,”Water Management” CRC Press, 2018
2. Neil S. Grigg , “Water resource management “ Wiley 2022

3. Uphoff.N., Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, No.11, Westview press, Boulder,CO, 1986.
4. J.V.S. Murthy, “Watershed Management”, New Age Publishers, New Delhi, Second Edition, 2017.
5. Sagar R.Chavhan, Shruti S.Agarwal,“Integrated Water Resources Planning and Management”, TechKnowledge Publications,2023

REFERENCE BOOKS:

1. Umesh Chandra Chaube, Ashish Pandey, Vijay P. Singh, “Canal Irrigation Systems in India” Springer,2023.
2. M.A. Nicholas Gudrich, Participatory Methods within the EU Water Framework Directive, Environmental and Sustainability Studies, 2015.
3. Rodolfo Soncini-Sessa, Francesca Cellina, Francesca Pianosi, Enrico Weber, Integrated and Participatory Water Resources Management – Practice, Elsevier Science, 2007.

| PEC601 | PO | | | | | | | | | | | | PS O | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | 1 | - | - | - | 1 | 1 | - | - | - | - | 2 | 1 | 1 | 1 |
| CO2 | - | 1 | - | - | - | - | - | 2 | - | 1 | - | - | 1 | 2 | 1 | 2 |
| CO3 | - | - | 1 | - | 1 | - | - | - | - | 2 | 2 | - | 2 | 1 | 1 | 1 |
| CO4 | 1 | 1 | - | - | - | - | - | - | - | | 2 | 2 | 2 | 1 | 1 | 2 |
| CO5 | 1 | - | 1 | - | 1 | 1 | - | 1 | - | 2 | 1 | 1 | 2 | 1 | 2 | 2 |
| Average | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.3 | 0.0 | 1.7 | 1.7 | 1.5 | 1.8 | 1.2 | 1.2 | 1.6 |

Geophysical methods – Selection of pumps.

UNIT- V WATER QUALITY

9

Ground water chemistry - Origin, movement and quality - Water quality standards
- Saltwater intrusion – Environmental concern.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Understand aquifer properties and its dynamics.
2. Get an exposure towards well design and practical problems
3. Develop a model for groundwater management.
4. Students will be able to understand the importance of artificial recharge and groundwater quality concepts
5. Gain knowledge on conservation of groundwater.

TEXTBOOKS:

1. BR Chahar, "Ground Water Hydrology", 2nd Edition ,Pearson, 2024
2. David Keith Todd "Ground Water Hydrology", Wiley, India , 2006
3. C Walton, "Ground Water Resource Evaluation", McGraw-Hill Publications, 2006
4. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
5. Santhosh Kumar Garg, Hydrology, Groundwater & Water Resources Engineering, 27th Edition Khanna publications.

REFERENCE BOOKS:

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, Scitech Publications (India) Pvt. Ltd. 2010

3. Kresic N, Groundwater Hydrology of Springs: Engineering Theory, Management, And Sustainability, Elsevier, 2010.
4. David K. Todd (Author), Larry W. Mays, Groundwater Hydrology, Wiley India, 2011.
5. Todd.D.K., Groundwater Hydrology An Indian Adaptation 3Ed. Wiley India. 2021.

| PEC602 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | 1 | - | - | - | 1 | 1 | - | - | - | - | 2 | 1 | 1 | 1 |
| CO2 | - | 1 | - | - | - | - | - | 1 | - | 1 | - | - | 1 | 2 | - | 2 |
| CO3 | - | - | 1 | - | 1 | - | - | - | - | - | - | - | 2 | 1 | - | 1 |
| CO4 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 1 | 1 | 2 |
| CO5 | - | - | - | - | 1 | 1 | - | 1 | - | 1 | 1 | 1 | 2 | 1 | 2 | - |
| Average | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.8 | 1.2 | 1.3 | 1.5 |

REFERENCE BOOKS:

1. Taha H.A., "Operation Research", McMillan Publication Co., New York, 1995.
2. Maass A., Husfchimidt M.M., Dorfman R., ThomasH A., Marglin S.A and Fair G. M., "Design of Water Resources System", Hardward University Press, Cambridge, Mass.,1995.
3. Goodman Aluvin S., "Principles of Water Resources Planning", Prentice Hall of India, 1984.
4. Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.
5. Daniel P Loucks and Eelco van Beek, "Water Resource Systems Planning and Management: An Introduction to Methods, Models and Applications", 2017

| PCE603 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | 1 | 1 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | 2 | 2 | 2 | 1 | 2 |
| CO3 | 2 | 3 | 2 | 2 | | 1 | 1 | 1 | | 1 | - | 2 | 1 | 1 | 2 | 2 |
| CO4 | 2 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | 2 | 1 | 1 | 2 | 2 |
| CO5 | 1 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 1 | 1 | 1 | 2 |
| Average | 2.0 | 2.0 | 1.8 | 1.5 | 2.8 | 1.0 | 1.0 | 1.0 | 0.0 | 1.5 | 0.0 | 1.8 | 1.2 | 1.2 | 1.6 | 2.0 |

- Jain, Water Resources Systems Planning & Management: Developments In Water Science, Elsevier Rs Excl Tec(40), 2012.

REFERENCE BOOKS:

- Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background Paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
- Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
- Technical Advisory Committee, Effective Water Governance”. Technical Advisory Committee Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
- Tony Allan, Virtual Water: Tackling the Threat to Our Planet’s Most Precious Resource, I. B. Taurus, 2011.
- Baldwin Claudia, Integrated Water Resource Planning, Taylor & Francis Ltd.

| PEC604 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | 1 | - | - | - | 1 | 1 | - | - | 2 | 2 | 2 | 1 | 1 | 1 |
| CO2 | - | 1 | - | - | 2 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | 2 |
| CO3 | - | - | 1 | - | 1 | - | - | - | - | - | 2 | 2 | 2 | 1 | 2 | 1 |
| CO4 | 1 | 1 | - | - | 2 | - | - | 1 | 2 | 1 | 2 | | 2 | 1 | 1 | 2 |
| CO5 | - | 2 | 1 | - | 1 | 1 | - | 1 | - | 1 | 1 | 1 | 2 | 1 | 2 | 2 |
| Average | 1.0 | 1.3 | 1.0 | 0.0 | 1.5 | 1.0 | 1.0 | 1.3 | 2.0 | 1.0 | 1.8 | 1.7 | 1.8 | 1.2 | 1.6 | 1.6 |

UNIT- III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts-Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis -Drought Prone Area Programme (DPAP)

UNIT- IV Water Management 9

Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT- V GROUNDWATER AND MANAGEMENT 9

Water for food production: 'blue' versus 'green' water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- Understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments
- Understanding the basic runoff concept and methods to estimate runoff
- Ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge
- Understand the water management principles and it's important in the health.
- Understand the concept and methods of ground water management.

TEXTBOOKS:

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010.

2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.
3. Sharad K. Jain, Vijay P. Singh, "Engineering Hydrology", McGraw Hill Professional, 2019.
4. Tim Davie, "Fundamentals of Hydrology", Routledge, 2003.
5. S. Lawrence Dingman, "Physical Hydrology: Third Edition", Waveland Press, 2015.

REFERENCE BOOKS:

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.
4. Tony Allan, Virtual Water: Tackling the Threat to Our Planet's Most Precious Resource, I. B. Taurus, 2011.
5. K. R. Rushton, "Groundwater Hydrology: Conceptual and Computational Models", John Wiley & Sons, 6 Feb 2004.

| PEC605 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | 2 | - | - | - | 1 | 2 | - | - | 2 | 2 | 2 | 1 | 1 | 1 |
| CO2 | - | 1 | - | - | 2 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | 2 |
| CO3 | - | - | 1 | - | 1 | - | - | - | - | - | 2 | 2 | 2 | 1 | 2 | 1 |
| CO4 | 1 | 1 | 2 | - | 2 | - | 2 | 1 | 2 | 1 | 2 | - | 2 | 1 | 1 | 2 |
| CO5 | - | 2 | 1 | - | 1 | 1 | - | 2 | - | 1 | 2 | 1 | 2 | 1 | 2 | 2 |
| Average | 1.0 | 1.3 | 1.5 | 0.0 | 1.5 | 1.0 | 1.5 | 1.8 | 2.0 | 1.0 | 2.0 | 1.7 | 1.8 | 1.2 | 1.6 | 1.6 |

5. Karl-Erich Lindenschmidt, "Surface Water Quality Modelling", MDPI AG, 2023.

REFERENCE BOOKS:

1. "Hydrodynamics and Water Quality: Modelling Rivers, Lakes, and Estuaries", Zhen-Gang Ji, John Wiley & Sons, 2018.
2. "Modelling Groundwater Flow and Contaminant Transport By Jacob Bear, A. H.-D. Cheng, Springer Science & Business Media, 2010.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.
4. "Mathematical Modelling of Groundwater Pollution" Ne-Zheng Sun, Alexander Sun, Springer New York, 2012
5. Robert V. Thomann, John A. Mueller, "Principles of Surface Water Quality Modeling and Control" Harper & Row, 1987.

| PEC606 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | 1 | - | - | - | 1 | 2 | - | - | 1 | 2 | 2 | 1 | 1 | 1 |
| CO2 | - | 1 | - | - | 2 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | 2 |
| CO3 | - | - | 1 | - | 1 | - | - | - | - | - | 2 | 2 | 2 | 1 | 2 | 1 |
| CO4 | 1 | 1 | 2 | - | 2 | - | 2 | 1 | 2 | 1 | 1 | - | 2 | 1 | 1 | 2 |
| CO5 | - | 1 | 1 | - | 1 | 1 | - | 1 | | 1 | 2 | 1 | 2 | 1 | 2 | 2 |
| Average | 1.0 | 1.0 | 1.3 | 0.0 | 1.5 | 1.0 | 1.5 | 1.5 | 2.0 | 1.0 | 1.5 | 1.7 | 1.8 | 1.2 | 1.6 | 1.6 |

UNIT- V CASE STUDIES / INDUSTRIAL APPLICATIONS

9

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments, Industry 4.0 concepts.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Understand the basics of IoT.
2. Implement the state of the Architecture of an IoT
3. Understand design methodology and hardware platforms involved in IoT.
4. Understand how to analyze and organize the data.
5. Compare IOT Applications in Industrial & realworld.

TEXTBOOKS:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017(unit 1,2,3,)
2. Internet of Things - A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015 (unit 5)
3. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education(unit 4)

REFERENCE BOOKS:

1. The Internet of Things - Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit2).
2. "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence",Jan Ho" ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O"Reilly Media,2011.

| OCS101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|------------|----------|----------|----------|---|------------|----------|----------|----------|----------|------------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 3 | 2 | | | | 2 | | | 1 | 2 | - | - | - |
| CO2 | 3 | 3 | 3 | 3 | | | | | | | | | - | 2 | - | - |
| CO3 | 3 | 3 | 3 | | 3 | | 2 | 1 | | 2 | | | - | - | 1 | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | | | | 2 | | - | - | 2 | - |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | | | 3 | 2 | 1 | - | 2 | - | 2 |
| Average | 3 | 3 | 3 | 3 | 2.5 | 3 | 2 | 1 | | 2.5 | 2 | 1 | 2 | 2 | 1.5 | 2 |

OBJECTIVES:

- To understand the need for machine learning for various problem solving.
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.
- To understand the latest trends in machine learning.
- To understand , analyze and organize the data using clustering methods.
- To design appropriate machine learning algorithms for problem solving.

UNIT- I INTRODUCTION 9

Machine learning -Examples of Machine Learning applications-Learning Associations- Classification-Regression-Unsupervised Learning-Reinforcement Learning-Supervised learning: Learning a class from Examples-Regression-Model Selection and Generalization. Case Study: Familiarity with R tool and Python programming language and libraries.

UNIT- II CONCEPT LEARNING AND DECISION-TREE LEARNING 9

Concept Learning - Concept learning Task - Concept Learning as search -Finding a maximally specific hypothesis - Version Spaces and Candidate elimination Algorithm -Inductive Bias Decision Tree Learning - Decision Tree representation - Problems for Decision Tree Learning - Hypothesis Search space - Inductive Bias in Decision Tree Learning - Issues in Decision Tree Learning.Case Study: Implementation of decision tree algorithm for problems in Retail Domain.

UNIT- III MULTILAYER PERCEPTRONS AND DEEP LEARNING 9

The Perceptron-Training a Perceptron-Learning Boolean Functions-Multilayer Perceptrons- MLP as Universal Approximator Back propagation Algorithm-Training Procedures Convolution Networks -The Convolution Operation-Pooling- Convolution and Pooling as an infinitely strong prior -Variants of the Basic Convolution Function -Structured Outputs -Data Types -Efficient Convolution Algorithms -Random and Unsupervised features.Case Study: Implementation of

Back propagation algorithm for problems in financial domain.

UNIT- IV CLUSTERING 9

Similarity-Based Clustering-Unsupervised learning problems-Hierarchical Agglomerative Clustering (HAC)-Single-link, complete link, group-average similarity-k-Means and Mixtures of Gaussians-Flat clustering-k-Means algorithms-Mixture of Gaussian model-EM-algorithm for mixture of Gaussian model. Case Study: Implementation of clustering algorithm for problems in financial/insurance/health care domain.

UNIT- V REINFORCEMENT LEARNING 9

Introduction - learning task - Q learning - The Q function - Algorithm for Q learning - convergence- experimentation strategies - updating sequence -Non deterministic rewards and actions - Temporal difference learning -Generalizing from examples - relationship to dynamic programming Case Study: Implementation of Q learning algorithm/reinforcement learning for problems in automotive domain/games.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Understand the basic ideas and objective of machine learning
2. Understand the problem of over fitting in machine learning.
3. Transfer concrete problems to machine learning problems and select appropriate models to solve them.
4. Understand how to analyze and organize the data using clustering methods.
5. Understand reinforcement learning algorithms and experiment strategies.

TEXTBOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", The MIT Press, September 2014, ISBN 978-0-262-02818-9.(Units 1,3(Multilayer Perceptrons) & 4)
2. Mitchell, Tom, "Machine Learning", New York, McGraw-Hill, First Edition, 2003. (Units 2,5)

REFERENCE BOOKS:

1. Ian GoodFellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press Book (Unit 3 - Convolutional Networks), Nov. 2016
2. Stephen Marshland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC 2009.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press (MA) 2012.

| OCS102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|----------|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - | 1 | - | - | 1 | - |
| CO2 | 1 | 1 | - | - | 1 | - | - | - | 1 | - | - | 1 | - | - | 1 | - |
| CO3 | 2 | 1 | 1 | - | - | - | 1 | - | 1 | 1 | - | 1 | - | - | 2 | - |
| CO4 | 1 | 1 | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 | - | 1 | 2 | - |
| CO5 | 1 | 1 | 1 | 1 | - | - | - | 1 | 1 | 1 | - | - | 1 | 1 | 2 | 2 |
| Average | 1.2 | 1 | 1.3 | 1 | 1 | 1 | 1 | - | 1 | - | - | 1 | 1 | 1 | 1.6 | 2 |

OCS103

TAMIL COMPUTING

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OBJECTIVES:

- To understand the Tamil grammar and programming basics for Tamil computing.
- To understand the various types of Tamil Computing applications.
- To make the students understand the use of Tamil computing tools and Resources.
- To strengthen the students' ability to carry out the Computational Linguistics in Tamil computing.
- To understand the concepts of Tamil text processing using open – Tamil python library.

UNIT- I TAMIL GRAMMAR 9

Introduction to Computational Linguistics-Grammars-Alphabets: Classification & Properties - Words: classification and components - Sentences: Structures and word ordering.

UNIT- II PROGRAMMING BASICS FOR TAMIL COMPUTING 9

History of Tamil Computing - Standards & Fonts - UNICODE - Object Oriented Tamil Computing - Tamil text processing using open-tamil python library.

UNIT- III COMPUTATIONAL LINGUISTICS 9

Basic linguistics - Phonology - Phonology computing - lexicography - syntax - semantics - pragmatics- Regular languages-and their limitations-Finite-state automata.

UNIT- IV TAMIL COMPUTING TOOLS & RESOURCES 9

POS Tagger - Morphological Analyser - Morphological Generator - Sentence Parser - Named Entity Recognizer - Word Sense Disambiguator - Ontologies.

UNIT- V TAMIL COMPUTING APPLICATIONS 9

Machine Translation -Information retrieval & Extraction - Question Answering - Text Summarization- Automatic Indexing - Text Mining - Conceptual Search.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Explain classification of Tamil grammar and properties.
2. Adopt a suitable process for tamil computing tools.
3. Analyze the different types of computational linguistics such as phonology, Morphology, lexicography.
4. Perform and analyze the Tamil computing applications.
5. Analyze and process the Tamil python library.

TEXTBOOKS:

1. The Oxford Handbook of Computational Linguistics, Edited by RuslanMitkov, Oxford University Press, 2014.
2. Tamil Computing ,Dr.R.Ponnusamy, Allied Publishers private limited, 2024

REFERENCE BOOKS:

1. Translation - Theory and Application, Valarmathi, International Institute of Tamil Studies, First Edition, 2001.
2. Tholkaappiyam - Thodariyal, Shanmugam, International Institute of Tamil Studies, First Edition, 2004.
3. J.E.Hopcroft, R.Motwani and J.D Ullman, - Introduction to Automata Theory, Languages and Computations, ThirdEdition, Pearson Education, 2013.
4. Natural language processing and computational linguistics, Bhargav SrinivasaDesikan Packt Publishing, first edition 2018.
5. The Phonology and morphology of tamil chrisdas Prathima, 2016.
6. Pos Tasser R Morphological Analzser Shodhganga inflibnet.ac.in

| OCS103 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|---|-----|---|---|---|---|---|---|----|----|----|-----|---|-----|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - | 1 | - | - | 1 | - |
| CO2 | 1 | 1 | - | - | 1 | - | - | - | 1 | - | - | 1 | - | - | 1 | - |
| CO3 | 2 | 1 | 1 | - | - | - | 1 | - | 1 | 1 | - | 1 | - | - | 2 | - |
| CO4 | 1 | 1 | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 | - | 1 | 2 | - |
| CO5 | 1 | 1 | 1 | 1 | - | - | - | 1 | 1 | 1 | - | - | 1 | 1 | 2 | 2 |
| Average | 1.2 | 1 | 1.3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.6 | 2 |

| | | | | | |
|---------------|---|----------|----------|----------|----------|
| OCY101 | CYBER FORENSIC AND INVESTIGATION | L | T | P | C |
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OBJECTIVES:

- Principles of digital evidence handling and forensic investigation techniques.
- Proficiency in using forensic tools for imaging, data recovery, and analysis.
- Understanding legal and ethical considerations in cyber investigations.
- Incident response planning and execution for cyber incidents.
- Documentation and reporting of forensic findings for stakeholders and legal purposes.

UNIT- I INTRODUCTION TO CYBER FORENSICS 9

Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Computer Forensics Systems – Vendor and Computer Forensics Services.

UNIT- II COMPUTER FORENSICS EVIDENCE AND CAPTURE 9

Data Recovery – Evidence Collection and Data Seizure - Duplication and Preservation of Digital Evidence-Computer Image Verification and Authentication.

UNIT- III COMPUTER FORENSIC ANALYSIS 9

Discovery of Electronic Evidence- Identification of Data – Reconstructing Past Events – Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies.

UNIT- IV INVESTIGATION 9

Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime- Identity Theft and Identity Fraud – Organized Crime & Terrorism – Avenues Prosecution and Government Efforts – Applying the First Amendment to Computer Related Crime-The Fourth Amendment and other Legal Issues.

UNIT- V COMPUTER FORENSIC INVESTIGATION CASES 9

Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence – Processing Evidence and Report Preparation – Future Issues.

COURSE OUTCOMES:

At the end of the course, learners will be able

1. To demonstrate proficiency in using forensic tools and techniques for digital evidence analysis.
2. To critically evaluate and interpret digital artifacts to reconstruct cyber incident timelines.
3. To apply legal and ethical principles to ensure compliance in cyber forensic investigations.
4. To formulate and implement incident response strategies to mitigate cyber threats effectively.
5. To prepare clear and comprehensive forensic reports and presentations for stakeholders.

TEXTBOOKS:

1. Marjie T. Britz, "Computer Forensics and Cyber Crime: Introduction to Digital Evidence," Pearson, 3rd Edition, 2021. (CHAPTERS 3 – 13). (UNIT IV – V)
2. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005. (CHAPTERS 1 – 18). (UNIT I – IV)

REFERENCE BOOKS:

1. Mark L. Merkow, "Information Security: Principles and Practices," Pearson, 4th Edition, 2020.
2. MariE-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.
3. Chad Steel, "Windows Forensics", Wiley, 1st Edition, 2006.
4. Majid Yar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover, 2nd Edition, 2013.
5. Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, Paperback, 1st Edition, 2004.

| OCY101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|----------|------------|----------|------------|----------|----------|----------|----------|----------|----------|----------|----------|------------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| CO2 | - | 3 | - | 3 | - | | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | - | 2 | | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | - | 2 | | - | - | - | - | - | - | - | - | - | 2 | | - |
| CO5 | 3 | - | - | 2 | - | 2 | - | - | - | - | - | - | - | - | 2 | - |
| Average | 2.7 | 2.5 | 2 | 2.5 | - | 2.5 | - | - | - | - | - | - | 3 | 2 | 2.5 | - |

OCY102

SOCIAL MEDIA SECURITY

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OBJECTIVES:

- To Understand Social Media Platforms: Learn how popular social media platforms work.
- To Identify Security Risks: Recognize threats and vulnerabilities on social media.
- To Privacy and Data Protection: Protect personal information on social media.
- To Legal and Ethical Issues: Understand legal and ethical issues in social media.
- To Security Best Practices: Apply methods to secure social media accounts.

UNIT- I INTRODUCTION TO SOCIAL MEDIA SECURITY 9

Social Media Platforms-Communication Impact-Cybersecurity Basics-Security Threats-User Awareness-Breach Case Studies-Data Collection-Security Features-Future Trends.

UNIT- II PRIVACY AND ACCOUNT SECURITY 9

Privacy Settings-Strong Passwords-Two-Factor Authentication (2FA)-Geotagging Risks Personal Information- Third-Party Apps-Account Takeover-Encryption Role-Safe Posting.

UNIT- III THREATS AND ATTACKS 9

Social Engineering-Cybercriminal Tactics-Suspicious Activity-Malware Links-Hacking Cases-Suspicious Content-Security Tests-Insider Threats -Threat Intelligence.

UNIT- IV LEGAL AND ETHICAL ISSUES 9

International Laws-Intellectual Property-Privacy Policies-Ethical Data Use-User Responsibilities-Legal Disputes- Freedom of Speech-Compliance Requirements-RegulationFuture.

UNIT- V ONLINE REPUTATION AND POLICIES**9**

Reputation Strategies-Brand Impact-Crisis Management-Corporate
Communication-Social Media Policies- Governance Role-Monitoring Tools-
Employee Training-Cybersecurity Integration.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. To Understand Social Media Platforms.
2. To Identify Security Threats.
3. To Protect Privacy and Apply best practices to protect personal information on social media.
4. To Address Legal and Ethical Issues.
5. To Apply Security Measures and Use tools and techniques to secure social media.

TEXTBOOKS:

1. Michael J. K. Lee, "Social Media Security: Leveraging Social Networking to Defend Against Cyber Threats," Elsevier, 1st Edition, 2019.
2. "Social Media Security: Leveraging Social Networking While Mitigating Risk" by Michael Cross.

REFERENCE BOOKS:

1. Sanjay Purighalla, "Cybersecurity and Social Media," CRC Press, 1st Edition, 2021.
2. "Phishing Dark Waters: The Offensive and Defensive Sides of Malicious Emails" by Christopher Hadnagy and Michele Fincher.
3. The Ethical Hack: A Framework for Business Value Penetration Testing" by James S. Tiller.

| OCY102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|------------|----------|------------|------------|---|---|---|---|----|----|----|----------|----------|------------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 2 | - | 3 | - | - | - | - | - | - | - | - | 3 | - | 2 | - |
| CO2 | - | 1 | - | 2 | - | - | - | - | - | - | - | - | 3 | - | 1 | - |
| CO3 | - | - | 1 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | 1 | - |
| CO4 | - | 1 | - | 2 | - | - | - | - | - | - | - | - | 3 | - | 2 | - |
| CO5 | 1 | 1 | - | 2 | 2 | - | - | - | - | - | - | - | 3 | 1 | 2 | - |
| Average | 1 | 1.2 | 1 | 2.2 | 2.5 | - | - | - | - | - | - | - | 3 | 1 | 1.6 | - |

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Emphasize the basic theory of evolution of communication techniques
2. Apply the concepts of 4G communication
3. Assess the need for 5G communication Techniques
4. Comprehend architecture and protocols for 5G communication
5. Understand the principles of dynamic spectrum management
6. Analyze the security aspects in 5G networks

TEXT BOOKS:

1. 5G Core networks: Powering Digitalization, Stephen Rommer, Academic Press, 2019.
2. An Introduction to 5G Wireless Networks: Technology, Concepts and Use cases, Saro Velrajan, First Edition, 2020.

REFERENCE BOOKS:

1. 5G Simplified: ABCs of Advanced Mobile Communications Jyrki. T.J.Penttinen, Copyrighted Material
2. 5G system Design: An end to end Perspective , Wan Lee Anthony, Springer Publications,2019

| OEC101 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 2 | 2 | - | - |
| CO2 | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | - | - | - |
| CO3 | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | - | - | - |
| CO4 | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | - | - | - |
| CO5 | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | - | - | - |
| CO6 | 3 | 2 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | 2 | - | - |
| Average | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | 2 | - | - |

| | | | | | |
|---------------|---------------------------------------|----------|----------|----------|----------|
| OEC102 | INTRODUCTION TO INDUSTRIAL IoT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand basic industrial processes and its reference architecture.
- To perceive the knowledge of networks and programming of IIOT.
- To study the role of sensors, actuators and communication protocols used for interfacing.
- To introduce and familiarize the industry 4.0.
- To master security in IIOT.
- To study application of IIOT in various fields

UNIT- I INTRODUCTION TO INDUSTRIAL IoT AND ITS ARCHITECTURE 9

IoT Introduction, Industrial Internet Architecture Framework – Functional Viewpoint – Operational Domain, Information Domain, Application Domain, Business Domain – Implementation View point – Architectural Topology – Three Tier Topology – Data Management.

UNIT- II NETWORKING AND PROGRAMMING OF IIoT 9

Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication. Industrial IoT- Layers: IIoT Communication, IIoT Networking. Industrial IoT: IIoT Analytics - Introduction, Machine Learning and Data Science, R and Julia Programming, Data Management with Hadoop.

UNIT- III SENSOR AND INTERFACING 9

Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet, Current, and M2M.

UNIT- IV COMPUTATION IN IIoT AND SECURITY 9

SDN in IIoT, Data Center Networks, Industrial IoT: Security and Fog Computing- Cloud Computing in IIoT, Industrial IoT Application Domains: Factories and Assembly Line, Food Industry.

UNIT- V IIoT APPLICATIONS 9

Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security: AR and VR safety applications, Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Interpret basic industrial processes and its reference architecture.
2. Comprehend to the modern networking technologies and programming of IIOT.
3. Illustrate the sensors, actuators and communication protocols used for interfacing.
4. Analyze the concepts and gain insights into Industry 4.0.
5. Handle real time security issues in IIOT.
6. Realize the importance of IIoT applications in real time.
7. Create numerous IOT applications with the physical world of humans and real life problem solving.

TEXT BOOKS:

1. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.2020
2. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress, 2017
3. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B.Rawart(Springer)

REFERENCE BOOKS:

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

2. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
3. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key, applications and Protocols", Wiley, 2012
5. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.

| OEC102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | 1 | - | - | - | - | - | - | - | - | 3 | 1 | 2 | - | - |
| CO2 | 1 | - | 1 | - | - | - | - | - | - | - | - | 2 | 2 | 2 | - | - |
| CO3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 | - | - |
| CO4 | 1 | - | 2 | - | - | - | - | - | - | - | - | 2 | 2 | 2 | - | - |
| CO5 | 2 | 1 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | - | - |
| CO6 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | - | - |
| Average | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | - | - |

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| OEC103 | ARDUINO PROGRAMMING AND IT'S APPLICATIONS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the evolution of IoT boards.
- To program Arduino to control lights, motors and other devices.
- To learn Arduino's architecture, including inputs and connectors for add-on devices.
- To add third-party components such as LCDs, accelerometers, gyroscopes, and GPS trackers to extend Arduino's functionality.
- To explore various options in programming Arduino boards.
- To test, debug, and deploy the Arduino to solve real world problems.

UNIT- I INTRODUCTION TO SENSORS 9

Transducers, Classification, Roles of sensors in IoT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IOT sensors, Role of actuators, types of actuators.

UNIT- II ARDUINO GPIOs and APIs 9

Hardware requirement for Arduino, Connecting remotely over the network using VNC, GPIO Basics, Controlling GPIO Outputs Using a Web Interface, APIs / Packages- Quark SOC processor.

UNIT- III ARDUINO INTERFACES 9

Sensor with Arduino- Humidity, Proximity, IR Motion, Accelerometer, Sound, Light Distance, Pressure, Thermal - Reading various sensor data on serial monitor and LCD Display.

UNIT- IV PROGRAMMING IN ARDUINO IoT DEVICE 9

Preparing the development environment (Arduino IDE), Exploring the Arduino language syntax, Coding, compiling, and uploading to the microcontroller, Working with Arduino Communication Modules: Bluetooth Modules, Wi-Fi Modules and I2C and SPI.

UNIT- V PROGRAMMING ESP 8266 MODULE**9**

ESP8266 Wi-Fi Serial Module: Overview, Setting Up the Hardware, Interfacing with Arduino, Creating an IoT Temperature and Humidity Sensor System, Overview of DHT-22 Sensor, Interfacing the Hardware: Arduino, ESP8266 WiFi Module, and DHT-22 Sensor, Checking Your Data via Thing Speak.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able to

1. Understand the basics of sensors, its functioning.
2. Execute basic and advanced assembly language programs.
3. Learn the ways to interface I/O devices with processor for task sharing.
4. Evoke the basics of co-processor and its ways to handle float values by its instruction set.
5. Recognize the functionality of micro controller, latest version processors and its applications.
6. Acquire design thinking capability, ability to design a component with realistic constraints, to solve real world engineering problems and analyse the results.

TEXTBOOKS:

1. Simon Monk, Hacking Electronics: Learning Electronics with Arduino and Raspberry Pi, 2nd Edition, McGraw-Hill Education, 2017.
2. Donald Norris, The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black, 1 st edition, McGraw Hill Education, 2015

REFERENCE BOOKS:

1. Marco Schwartz, Home Automation with Arduino, 3rd edition, Open Home Automation 2014.
2. Schwartz, Marco. Internet of things with arduino cookbook, 1st edition, Packt Publishing Ltd, 2016.
3. Kooijman, Matthijs. Building Wireless Sensor Networks Using Arduino, 1st edition, Packt Publishing Ltd, 2015

| OEC103 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 2 | - | - |
| CO2 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | - | - | - |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | - | - | - |
| CO4 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | - | - | - |
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | - | - | - |
| CO6 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | - | - |
| Average | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | - | - |

UNIT- IV DRYING PROCESS FOR TYPICAL FOODS & FOOD WASTES 9
IN VARIOUS PROCESSES

Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixtures. Psychometric chart, freezing and cold storage, freeze concentration, dehydro-freezing, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages. Waste disposal-solid and liquid waste, rodent and insect control, use of pesticides, ETP, selecting and installing necessary equipment.

UNIT- V FOOD HYGIENE 9

Food related hazards – Biological hazards – physical hazards – microbiological considerations in foods. Food adulteration – definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training & Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

1. Aware of the different methods applied to preserving foods.
2. Explain the food handling and storage processes.
3. Analyze the thermal and non-thermal processing methods.
4. Explore the drying process of foods.
5. Understand Food Hazards, Adulteration, and Safety in handling and procurement & Microbial considerations and sanitation.

TEXTBOOKS:

1. Karnal, Marcus and D.B. Lund “Physical Principles of Food preservation”. Rutledge, 2003.
2. VanGarde, S.J. and Woodburn. M “Food Preservation and Safety Principles and

Practice”.Surbhi Publications, 2001.

3. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
4. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

REFERENCE BOOKS:

1. Shafiur M Rahman, “Handbook of Food Preservation”, Second Edition, CRC Press, 2007
2. Zeuthen Peter, Bogh-Sorensen Leif, “Food Preservation Techniques”, Wood Head Publishing, Cambridge, England, 2005.
3. Ranganna S, “Handbook of Canning and Aseptic Packaging”, Tata McGraw-Hill, 2000.

| OMD101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|------------|------------|---|----------|----------|----------|---|----|----|----------|-----|----------|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | - | 3 | - | 1 | 1 | - | - | - | - | - | - | 1 | | |
| CO2 | 2 | 3 | 1 | 2 | - | - | - | 2 | - | - | - | 2 | - | 1 | | |
| CO3 | 3 | 2 | 1 | 2 | - | 1 | 1 | - | - | - | - | 2 | - | 1 | | |
| CO4 | 3 | 2 | 1 | 2 | - | 1 | 1 | - | - | - | - | 2 | - | 1 | | |
| CO5 | 3 | 1 | 2 | - | - | 1 | 1 | - | - | - | - | 2 | - | 1 | | |
| Average | 3 | 2 | 1.3 | 2.3 | - | 1 | 1 | 2 | - | - | - | 2 | - | 1 | | |

UNIT- V BIOCHEMICAL MEASUREMENTS

9

Biochemical sensors - pH, pO₂ and pCO₂, Ion selective Field effect Transistor (ISFET), immunologically sensitive FET (IMFET), Blood glucose sensors. Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Illustrate the origin of various biological signals and their characteristics.
2. Apply knowledge of bio signal characteristics.
3. Gain knowledge on various amplifiers involved in monitoring bio signals.
4. Identify appropriate instruments and methods for each physiological parameter.
5. Examine the biochemical measurement techniques.

TEXTBOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hall of India, New Delhi, 2015.
2. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS:

1. John Enderle, Susan Blanchard, Joseph Bronzino, "Introduction to Biomedical Engineering", second edition, Academic Press, 2005.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

| OMD102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|---|---|---|---|---|----|----------|----|----------|----------|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 1 | - | - |
| CO2 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 1 | - | - |
| CO3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 1 | - | - |
| CO4 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | 1 | - | 2 | 1 | - | - |
| CO5 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | 1 | - | 2 | 1 | - | - |
| Average | 3 | 2 | 1 | 1 | - | - | - | - | - | - | 1 | - | 2 | 1 | - | - |

| | | | | | |
|---------------|---------------------------------|----------|----------|----------|----------|
| OEE101 | RENEWABLE ENERGY SOURCES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To know the Indian and global energy scenario.
- To learn the various solar energy technologies and its applications.
- To educate the various wind energy technologies.
- To explore the various bio-energy technologies.
- To study the ocean and geothermal technologies.

UNIT- I ENERGY SCENARIO 9

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans.

UNIT- II SOLAR ENERGY 9

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT- III WIND ENERGY 9

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics – Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

UNIT- IV BIO-ENERGY 9

Bio resources – Biomass direct combustion – thermochemical conversion – biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers – Cogeneration – Carbonization – Pyrolysis - Biogas plants – Digesters – Biodiesel production – Ethanol production - Applications.

UNIT- V OCEAN AND GEOTHERMAL ENERGY**9**

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. Discuss the Indian and global energy scenario.
2. Describe the various solar energy technologies and its applications.
3. Explain the various wind energy technologies.
4. Explore the various bio-energy technologies.
5. Discuss the ocean and geothermal technologies

TEXTBOOKS:

1. Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 :9390385636.
2. Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10: 8120344707.

REFERENCE BOOKS:

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2. Rai.G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
3. Sukhatme.S.P., “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.

5. Twidell, J.W. & Weir A., “Renewable Energy Resources”, EFN Spon Ltd., UK, 2015.

| OEE101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| CO2 | 3 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| CO5 | 3 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| Average | 3 | 3 | 2 | - | - | 1 | - | - | - | - | - | - | 3 | - | - | - |

REFERENCE BOOKS:

1. Michael P.Deru, Jim Kelsey, 'Procedures for Commercial Building Energy Audits', American Society of Heating, Refrigerating and Air conditioning Engineers, 2011.
2. Charles M. Gottschalk, 'Industrial Energy Conservation', Wiley, 1996.

| OEE102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|------------|----------|------------|------------|------------|----------|----------|----------|----------|----------|------------|------------|----------|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 1 | | 1 | | 3 | | | | 2 | | | 1 | | | |
| CO2 | | | 2 | | 1 | | | | 2 | | | 1 | 1 | 2 | | |
| CO3 | | 1 | | 3 | | 2 | | | | | | | 1 | | | |
| CO4 | 3 | | | | | 3 | | 2 | | | 2 | | 1 | | | |
| CO5 | | 2 | | 3 | 2 | | 1 | 2 | | | | 2 | 2 | | | |
| Average | 2 | 1.3 | 2 | 2.3 | 1.5 | 2.6 | 1 | 2 | 2 | 2 | 2 | 1.5 | 1.2 | 2 | | |

| | | | | | |
|---------------|-------------------------------------|----------|----------|----------|----------|
| OEE103 | ELECTRIC AND HYBRID VEHICLES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To know about the general aspects of Electric and Hybrid Vehicles (EHV), including architectures.
- To acquire the knowledge on modelling, sizing of batteries.
- To understand the working principle, construction and characteristics of various motors.
- To provide knowledge about various power converters and control.
- To understand the Hybrid and Electric vehicles.

UNIT- I DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES 9

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency-. History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles.

UNIT- II ENERGY SOURCES 9

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion Sodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra-capacitors. Battery Management System.

UNIT- III MOTORS AND DRIVES 9

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

Heinemann Publication,2005.

| OEE103 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|----------|----------|------------|---|---|----|----------|------------|------------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 3 | 2 | 3 | 2 | | | | | 1 | 1 | 2 | | 2 | |
| CO2 | 3 | 3 | 3 | 2 | 3 | 2 | | | | | | 1 | | 1 | | 1 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | | | | | 2 | 2 | | | 1 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | | | | | 1 | 1 | | | | |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | | | | 1 | 1 | 1 | | | |
| Average | 3 | 3 | 3 | 2 | 3 | 2 | 2.5 | | | | 1 | 1.2 | 1.6 | 1 | 2 | 1 |

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|---------------|---------------------------------|----------|----------|----------|----------|
| OEI101 | FUNDAMENTALS OF ROBOTICS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES

- Understand the functions of robots and review the need and application of robots in different engineering fields.
- Exemplify the different types of robot drive systems as well as robot end effectors.
- Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
- Develop robotic programs for different tasks and analyze the kinematics motions of robot.
- Implement robots in various industrial sectors and interpolate the economic analysis of robots.

UNIT-I INTRODUCTION TO ROBOTICS 9

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT-II DRIVE SYSTEMS AND GRIPPERS 9

Pneumatic Drives-Hydraulic Drives-Electrical Drives- Fundamental features and Applications of A.C & D.C. Servo Motors, Stepper Motors, Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Selection and Design Considerations

UNIT-III SENSORS FOR ROBOT 9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors,

McGraw Hill, 2001.

REFERENCE BOOKS

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
2. Deb.S.R., "Robotics Technology and Flexible Automation", Tata McGraw Hill Book Co. 1994.
3. Koren Y., "Robotics for Engineers", McGraw Hill Book Co., 1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence",McGraw Hill Book Co., 1987.
5. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.

| OEI101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | 1 | 1 | | | | 1 | | | | | 1 | 1 | 1 | |
| CO2 | 2 | 3 | 1 | 2 | | | | | 1 | 1 | | | 2 | 2 | 3 | |
| CO3 | 2 | 3 | 2 | 3 | | 3 | 2 | 1 | 2 | 1 | | 1 | 2 | 2 | 1 | |
| CO4 | 2 | 1 | | | 1 | | | | | | | | | | 1 | |
| CO5 | 2 | 1 | 3 | 1 | 3 | 2 | 2 | 1 | | | 2 | 2 | 1 | 2 | 1 | |
| Average | 2.2 | 1.8 | 1.8 | 1.8 | 2.0 | 2.5 | 2.0 | 1.0 | 1.5 | 1.0 | 2.0 | 1.5 | 1.5 | 1.8 | 1.4 | - |

| | | | | | |
|---------------|--------------------------------|----------|----------|----------|----------|
| OEI102 | SENSORS FOR ENGINEERING | L | T | P | C |
| | APPLICATIONS | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES

- To know the various stimuli that are to be measured in real life instrumentation.
- To select the right process or phenomena of the sensor.
- To aware of the various sensors available for measurement and control applications.

UNIT-I INTRODUCTION TO SENSORS 9

What is a sensor and what is a transducer? Electrical sensor – need for sensors in the modern world. Different fields of sensors based on the stimuli - various schematics for active and passive sensors. General characteristics and specifications of sensors - Implications of specifications uses of sensors - measurement of stimuli - block diagram of sensor system. Brief description of each block.

UNIT-II TRANSDUCERS 9

Sensors for mechanical systems or mechanical sensors - Displacement - acceleration and force - flow of fluids - level indicators - pressure in fluids - stress in solids. Typical sensors - wire and film strain gauges, anemometers, piezo electric and magnetostrictive accelerometers, potentiometric sensors, LVDT.

UNIT-III TEMPERATURE SENSORS 9

Thermal sensors – temperature – temperature difference – heat quantity. Thermometers for different situation – thermocouples thermistors – color pyrometry. Optical sensors: light intensity – wavelength and color – light dependent resistors, photodiode, photo transistor- Radiation detectors: radiation intensity, particle counter – Gieger Muller counter (gas based), Hallide radiation detectors.

UNIT-IV MAGNETIC SENSORS 9

Introduction- magnetic field, magnetic flux density – magneto resistors, Hall sensors, super conduction squids. Acoustic or sonic sensors: Intensity of sound, frequency of sound in various media, various forms of microphones, piezo electric sensors.

UNIT-V ELECTRICAL SENSORS 9

Introduction- conventional volt and ammeters, high current sensors, (current transformers), high voltage sensors, High power sensors. High frequency sensors like microwave frequency sensors, wavelength measuring sensors. MEMs and MEM based sensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Appreciate the operation of various measuring and control instruments which they encounter in their respective fields.
- Visualize the sensors and the measuring systems when they have to work in areas of interdisciplinary nature.
- Also think of sensors and sensors systems when for a new situation they encounter in their career
- Identify and select the right process or phenomena on which the sensor should depend on.
- Know various stimuli that are to be measured in real life instrumentation.

TEXTBOOKS

1. Doebelin, "Measurement Systems: Application and Design", McGraw Hill Kogakusha Ltd.
2. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim "Microsensors, MEMS and Smart Devices", New York: Wiley, 2001.
3. Henry Bolte, "Sensors – A Comprehensive Sensors", John Wiley.

| OEI102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 2 | 1 | 1 | 2 | | 2 | |
| CO2 | 2 | | 2 | 2 | | | 1 | | | | | | | | | |
| CO3 | 2 | 2 | | | | 1 | 1 | | | | | 1 | 1 | 2 | | |
| CO4 | 3 | 3 | 3 | 3 | 1 | | | 3 | 1 | 2 | | | | | | |
| CO5 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | |
| Average | 2.4 | 2.0 | 2.3 | 2.0 | 1.0 | 1.0 | 1.0 | 2.7 | 1.0 | 1.7 | 1.0 | 1.0 | 1.7 | 2.0 | 2.0 | 0 |

OBJECTIVES:

- Provide a comprehensive understanding of multimedia concepts and components.
- Equip students with the knowledge to design and handle multimedia systems and files.
- Develop skills in multimedia authoring, hypermedia messaging, and user interface design.
- Introduce augmented reality techniques and their integration with existing development environments.
- Explore virtual reality techniques and their applications in creating immersive experiences.

UNIT- I INTRODUCTION TO MULTIMEDIA 9

Multimedia - Multimedia system architecture – Evolving technologies for multimedia -Components of multimedia – Multimedia Hardware and Software- Web and Internet multimedia applications –Data Representation: Text, Images, Audio, Video -Transition from conventional media to digital media.

UNIT- II MULTIMEDIA SYSTEM DESIGN & FILE HANDLING 9

Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases- Compression and decompression– Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

UNIT- III HYPERMEDIA 9

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems. CASE STUDY: Blender graphics and Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures.

REFERENCE BOOKS:

1. Li, Z., Drew, M., & Liu, J. (2004). Fundamentals of Multimedia. Pearson. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Furht, B. (Ed.). (1998). Handbook of Multimedia Computing. CRC Press.
3. Billinghamurst, M., Clark, A., & Lee, G. (2015). A Survey of Augmented Reality. Foundations and Trends® in Human-Computer Interaction, 8 (2-3), 73-272.
4. Sherman, W. R., & Craig, A. B. (2018). Understanding Virtual Reality: Interface, Application, and Design (2nd ed.). Morgan Kaufmann.

List of Open Source Software/ Learning website:

1. Tay Vaughan, "Multimedia: Making It Work," Tata McGraw-Hill, 2008.
2. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia," Pearson Education, 2004.
3. Gaurav Bhatnagar and Shikha Mehta, "Introduction to Multimedia Systems," Cambridge University Press, 2000.
4. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile," O'Reilly Media, 2015.

| OIT101 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | - | 1 | 1 | - | - | - | 2 | 3 | 1 | 3 | 2 | 1 | - |
| CO2 | 1 | - | 2 | - | 3 | 3 | - | - | - | 3 | 3 | 1 | 1 | - | 2 | - |
| CO3 | 3 | 2 | 2 | - | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | - |
| CO4 | 3 | 3 | 3 | - | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | - |
| CO5 | 3 | 3 | 3 | - | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | - |
| Average | 2.6 | 2.4 | 2.4 | - | 2.2 | 1.4 | 1.0 | 1.0 | 1.0 | 1.6 | 1.8 | 1.0 | 2.6 | 2.0 | 2.3 | - |

Manufacturing (AM)Processes of Titanium Alloy”, InTech, 2012.

| OIT102 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|------------|------------|----------|---|---|---|---|----|----------|----------|-----|---|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 2 | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| CO2 | - | 2 | 3 | - | 2 | - | - | - | - | - | - | 2 | - | - | - | - |
| CO3 | - | - | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | - | - | - | 3 | 2 | - | - | - | - | - | 2 | - | - | - | 3 | 2 |
| CO5 | - | - | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 1 |
| Average | 2 | 2 | 2.2 | 2.6 | 2 | - | - | - | - | - | 2 | 2 | - | - | 2.6 | 1.6 |

OBJECTIVES:

- Design static web page using Markup languages.
- Design and implement web pages using style sheets.
- Implement with java script web applications with dynamic web pages.
- Understand working of Web servers and Design Methodologies with MVC Architecture.
- Develop web applications using XML.

UNIT- I INTRODUCTION TO WEB FRAMEWORKS 9

Basics of web development – Overview of web frameworks - MVC architecture - Popular web frameworks: Django, Flask, Ruby on Rails, Laravel, Express.js - Benefits of using web frameworks

UNIT- II CLIENT- SIDE FRAMEWORKS 9

Introduction to client-side frameworks - React.js: Components, JSX, State and Props, Lifecycle Methods - Angular: Modules, Components, Services, Directives, Data Binding - Vue.js: Vue instance, Templates, Components, Vue Router

UNIT- III SERVER - SIDE FRAMEWORKS 9

Introduction to server-side frameworks - Django: Models, Views, Templates, Forms, Admin Interface - Flask: Routing, Templates, WTFForms, SQLAlchemy - Node.js with Express.js:Middleware, Routing, Templating, REST APIs

UNIT- IV DATABASE INTEGRATION 9

Database fundamentals - SQL vs NoSQL databases - ORM (Object-Relational Mapping) concepts - Integrating databases with Django (using Django ORM) - Integrating databases with Flask (using SQLAlchemy) - Integrating databases with Node.js using Mongoose for MongoDB

UNIT- V FULL-STACK DEVELOPMENT 9

Overview of full-stack development - RESTful APIs and Web Services -

Authentication and Authorization - Deployment and Hosting - Case Studies:
Building a full-stack application with React and Django/Node.js.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Understand the fundamental concepts and architecture of web frameworks.
2. Develop web applications using client-side frameworks.
3. Build dynamic server-side applications with popular server-side frameworks.
4. Integrate databases and manage data within web applications.
5. Implement full-stack web applications combining client side and server-side technologies.

TEXTBOOKS:

1. "Web Development with Node and Express: Leveraging the JavaScript Stack" by Ethan Brown Unit 1,3,4,5
2. "Django for Beginners: Build websites with Python and Django" by William S. Vincent Unit 1,3,5
3. "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux" by Kirupa Chinnathambi Unit 2,5

REFERENCE BOOKS:

1. "Flask Web Development: Developing Web Applications with Python" by Miguel Grinberg Unit 3,4
2. "Pro Angular 9: Build Powerful and Dynamic Web Apps" by Adam Freeman Unit 2
3. "Full-Stack Vue.js 2 and Laravel 5: Bring the frontend and backend together with Vue, Vuex, and Laravel" by Anthony Gore Unit 1,5

| OIT103 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|----------|---|---|---|------------|------------|------------|----------|----------|------------|------------|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 2 | 2 | 3 | - | - | - | - | 2 | 1 | 2 | 3 | 2 | 2 | - |
| CO2 | 2 | 3 | 3 | 2 | 3 | - | - | - | 2 | 3 | 2 | 2 | 3 | 2 | 3 | - |
| CO3 | 2 | 3 | 3 | 3 | 3 | - | - | - | 2 | 2 | 2 | 2 | 3 | 2 | 3 | - |
| CO4 | 2 | 2 | 3 | 2 | 3 | - | - | - | 2 | 2 | 1 | 2 | 3 | 3 | 3 | - |
| CO5 | 2 | 3 | 3 | 3 | 3 | - | - | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 | - |
| Average | 2.2 | 2.6 | 2.8 | 2.4 | 3 | - | - | - | 1.6 | 2.4 | 1.8 | 2 | 3 | 2.4 | 2.8 | - |

| | | | | | |
|---------------|-----------------------------------|----------|----------|----------|----------|
| OAD101 | FOUNDATION OF DATA SCIENCE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.

UNIT- I INTRODUCTION 9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data.

UNIT- II DATA MANIPULATION 9

Notebook - IPython Magic Commands - NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance.

UNIT- III MACHINE LEARNING 9

The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis.

UNIT- IV DATA VISUALIZATION 9

Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT- V HANDLING LARGE DATA**9**

Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able to

1. Gain knowledge on data science process.
2. Perform data manipulation functions using Numpy and Pandas.
3. Understand different types of machine learning approaches.
4. Perform data visualization using tools.
5. Handle large volumes of data in practical scenarios.

TEXTBOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCE BOOKS:

1. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014

| OAD101 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|---|---|---|-----|-----|-----|-----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 3 | 2 | 3 | 2 | - | - | - | 3 | 1 | 3 | 2 | - | - | - | - |
| CO2 | 2 | 2 | 2 | 3 | 3 | - | - | - | 2 | 2 | 3 | 2 | - | - | - | - |
| CO3 | 3 | 3 | 3 | 3 | 2 | - | - | - | 2 | 3 | 1 | 1 | - | - | - | - |
| CO4 | 2 | 3 | 2 | 3 | 2 | - | - | - | 3 | 3 | 3 | 3 | - | - | - | - |
| CO5 | 2 | 3 | 2 | 2 | 3 | - | - | - | 3 | 3 | 1 | 3 | - | - | - | - |
| Average | 2.4 | 2.8 | 1.3 | 2.8 | 2.4 | - | - | - | 2.6 | 2.4 | 2.2 | 2.2 | - | - | - | - |

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|---------------|-----------------------------------|----------|----------|----------|----------|
| OAD102 | OPEN SOURCE SOFTWARE TOOLS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the basic concepts of open source software.
- To understand about open source databases.
- To understand about the open source programming languages.
- To understand and apply the concepts in python language.
- To understand the real world problems using case studies.

UNIT- I INTRODUCTION 9

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources–Application of Open Sources. Open source operating systems: LINUX: Introduction –General Overview – Kernel Mode and user mode – Process – Advanced Concepts –Scheduling – Personalities – Cloning – Signals – Development with Linux.

UNIT- II OPEN SOURCE DATABASE 9

MySQL: Introduction – Setting up account – Starting, terminating and writing your ownSQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Usingsequences – MySQL and Web.

UNIT- III OPEN SOURCE PROGRAMMING LANGUAGES 9

PHP: Introduction – Programming in web environment – variables – constants –data;types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates.

UNIT- IV PYTHON 9

Syntax and Style – Python Objects – Numbers – Sequences – Strings –

Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

UNIT- V CASE STUDIES

9

Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Explain the basic concepts of open source softwares.
2. Excel in open source databases.
3. Understand about open source programming languages.
4. Apply the concepts using python.
5. Understand the real world problems using the case studies.

TEXTBOOKS:

1. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2003.
2. Steve Suchring, "MySQL Bible", John Wiley, 2002 .
3. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", Laxmi Publications Pvt Ltd 2012, 1st Edition.

REFERENCE BOOKS:

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002.
2. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2001.
3. Martin C. Brown, "Perl: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
4. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
5. Vikram Vaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw- Hill Publishing Company Limited, Indian Reprint 2009.

6. Fadi P. Deek and James A. M. McHugh, "Open Source: Technology and Policy", Cambridge Universities Press 2007.

| OAD102 | PO | | | | | | | | | | | | PSO | | | | |
|----------------|------------|---|------------|---|------------|---|---|---|---|----|----|----|-----|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 1 | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 1 | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | - | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Average | 2.0 | - | 1.6 | - | 1.0 | - | - | - | - | - | - | - | - | - | - | - | - |

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|---------------|---|----------|----------|----------|----------|
| OME101 | REFRIGERATION AND AIR CONDITIONING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To introduce the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems.
- To study the Vapour absorption and air refrigeration systems.
- To learn the psychrometric properties and processes.
- To study the air conditioning systems and load estimation.

UNIT- I INTRODUCTION 9

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT- II VAPOUR COMPRESSION REFRIGERATION SYSTEM 9

Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multipressure system -low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT- III OTHER REFRIGERATION SYSTEMS 9

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration – Magnetic Vortex and Pulse tube refrigeration systems.

UNIT- IV PSYCHROMETRIC PROPERTIES AND PROCESSES 9

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT- V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION 9

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Explain the basic concepts of Refrigeration
2. Explain the Vapor compression Refrigeration systems and to solve problems
3. Discuss the various types of Refrigeration systems
4. Calculate the Psychrometric properties and its use in psychrometric processes
5. Explain the concepts of Air conditioning and to solve problems

TEXTBOOKS:

1. Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010
2. Textbook of Refrigeration And Air-Conditioning (M.E.)by R.S. Khurmi | 10 February 2019

REFERENCE BOOKS:

1. ASHRAE Hand book, Fundamentals, 2010
2. JonesW.P., "Air conditioning engineering", 5th edition, Elsevier Butterworth - Heinemann, 2007.

| OME101 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | - | - |
| CO2 | 2 | 1 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | - | - |
| CO3 | 2 | 1 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | - | - |
| CO4 | 2 | 1 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | - | - |
| CO5 | 2 | 1 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | - | - |
| Average | 2 | 1 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 2 | 2 | - | - |

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| OME102 | ADVANCED MANUFACTURING PROCESSES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

1. To describe the concepts of various metal casting processes.
2. To demonstrate the concepts of various metal joining processes.
3. To describe unconventional machining processes
4. To demonstrate thermal and electrical based processes.
5. To describe the chemical and electrochemical-based process parameters, their influence on performance, and their application.

UNIT- I METAL CASTING 9

Casting terminology, pattern material, allowance; Pattern types: Single piece, split, gated; Core prints, moulding sand properties, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Melting furnaces: Blast and Cupola Furnaces; Principle of special casting processes: Shell - investment - Ceramic mould - Pressure die casting - Centrifugal Casting - Stir casting; Defects in Sand casting

UNIT- II JOINING PROCESSES 9

Operating principle, basic equipment, merits and applications of fusion welding processes: Gas welding - Types - Flame characteristics; Manual metal arc welding - Gas Tungsten arc welding - Gas metal arc welding - Submerged arc welding - Electro slag welding; Operating principle and applications of resistance welding - Plasma arc welding - Thermit welding - Electron beam welding - Friction welding and Friction Stir Welding. brazing, soldering and adhesive bonding; Weld defects: types, causes and cure.

UNIT- III MECHANICAL ENERGY BASED PROCESSES 9

Unconventional machining Process – Need – classification – merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – Ultrasonic Machining - (AJM, WJM, AWJM and USM) - Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT- IV THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipment - Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits- Tool Wear –Dielectric – Flushing – Applications. Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM) – Working Principles – Equipment –Types – Beam control techniques – Applications.

UNIT- V CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED 9 PROCESSES

Chemical machining and Electro-Chemical machining (CHM and ECM) - Etchants – Maskant – techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- Equipment -Surface Roughness and MRR Electrical circuit -Process Parameters ECG and ECH – Applications.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Understand the various metal casting processes.
2. Understand the various metal joining techniques.
3. Describe the unconventional machining processes and the mechanical processes.
4. Understand the thermal and electrical-based processes.
5. Understand the chemical and electrochemical-based process parameters, their influence on performance, and their application.

TEXTBOOKS:

1. Serope Kalpakjian, Steven R.Schmid, “Manufacturing Engineering and
2. P.N. Rao, “Manufacturing Technology: Foundry, Forming and Welding – Volume 1”, Tata McGraw-Hill Publishing Limited, 2019.

REFERENCE BOOKS:

1. P.C. Sharma, “A text book of Production Technology (Manufacturing

Processes)”, S. Chand and Company, 8th Edition 2014.

2. S.Gowri, P.Hariharan, and A.Suresh Babu, “Manufacturing Technology 1”, Pearson Education, 2020.

E- RESOURCES:

<https://archive.nptel.ac.in/courses/112/107/112107219>

<https://archive.nptel.ac.in/courses/112/105/112105212>

| OME102 | PO | | | | | | | | | | | | PSO | | | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 1 | - | - |
| CO2 | 2 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 1 | - | - |
| CO3 | 2 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 1 | - | - |
| CO4 | 2 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 1 | - | - |
| CO5 | 2 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 1 | - | - |
| Average | 2 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 2 | - | - |

OME103

**MATERIAL TESTING AND
CHARACTERIZATION**

L T P C
3 0 0 3

OBJECTIVES:

The main learning objective of this course is:

- To describe the phase structure of metals/alloys.
- To demonstrate the heat treatment process employed for various materials.
- To describe the classification of ferrous and nonferrous alloys.
- To describe the Practical exposure towards microstructure of Engineering Materials.
- To demonstrate the Mechanical testing tools for engineering materials.

UNIT- I BINARY PHASE DIAGRAM 9

Solid solutions: Substitutional and interstitial – Compound – Phase diagram: Classification - Phase reactions with an example: Isomorphous, eutectic, eutectoid, peritectic and peritectoid, Iron – Iron carbide diagram.

UNIT- II HEAT TREATMENT PROCESSES 9

Full, stress relief, recrystallization and spheroidizing annealing – normalizing, hardening and tempering of steel –phase transformation - Isothermal transformation (TTT) diagram for Eutectoid Steel – cooling curves - CCR –Hardenability - Jominy end quench test – Austempering - martempering. Case hardening - carburizing, nitriding, cyaniding, carbo- nitriding, flame and induction hardening

UNIT- III FERROUS ALLOYS 9

Classification, properties, microstructure, processing and applications of low, medium & high carbon steel & FG, SG, White, Malleable cast iron – effect of alloying elements on steel (Cr, Mo, V, Ti, Ni & W) - stainless steel and tool steels - HSLA steel & Maraging steels – Die steel, Wear of Metals - BIS Specification.

UNIT- IV NON-FERROUS ALLOYS 9

Properties, Composition, Applications: Copper and its alloys - Brass, Bronze and Cupronickel – Aluminium and its alloys – Duralumin- Bearing alloys. Nickel and

E- RESOURCES:

<https://nptel.ac.in/courses/112108150>

<https://www.digimat.in/nptel/courses/video/113107078/L01.html>

| OME103 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO2 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO3 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO4 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO5 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | - |
| Average | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 2 | 1 | 1 | - | - |

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|---------------|-----------------------------------|----------|----------|----------|----------|
| OME104 | HAZARDOUS WASTE MANAGEMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- At the end of the course the student shall be able to understand the type, nature of hazardous wastes.
- To study the hazardous wastes management.
- To study the biomedical waste management.
- To study the radioactive waste management.
- To study the E-Waste Management.

UNIT- I INTRODUCTION 9

Hazardous waste definition- Regulatory aspects of Hazardous Waste Management in India – Sources, characterization, categories - Analysis of hazardous waste - Physical and biological routes of transport of hazardous substances.

UNIT- II HAZARDOUS WASTES MANAGEMENT 9

Handling, collection, storage and transport- TSDF concept -Hazardous waste treatment technologies-Physical, chemical and thermal treatment of hazardous waste–Solidification- Chemical fixation–Encapsulation-Pyrolysis and Incineration– Biological Treatment of Hazardous Waste, Hazardous waste landfills-Site selections- design and operation-HW reduction- Recycling and reuse–Hazardous Site remediation – onsite and offsite Techniques.

UNIT- III BIOMEDICAL WASTE MANAGEMENT 9

Biomedical waste–Definition– Regulatory aspects of Biomedical Waste. Sources– Classification– Waste Handling and Collection–Segregation and labeling- Treatment – autoclaving, Incineration, Chemical Disinfection – disposal-Infection control Practices.

UNIT- IV RADIOACTIVE WASTE MANAGEMENT 9

Radioactive waste: Definition–Measurement of Radiation -Sources-Effects -Low level and high level radioactive wastes-Transuranic Waste-and their management– Uranium Mine and Tailings, Characterization – Treatment and Control - Radiation

standard by ICRP and AERB.

UNIT- V E-WASTE MANAGEMENT

9

Regulatory aspects of E-I Waste management, Waste characteristics- Generation -- Collection - Material Composition-Transport– Treatment and disposal. Recycling and Recovery – intergraded e-waste management.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to

1. Gain the knowledge of the type, nature hazardous wastes.
2. Ability to plan minimization of hazardous wastes.
3. Ability to handle the bio medical Waste.
4. Ability to handle the radioactive waste.
5. Ability to handle the E- Waste Management.

TEXTBOOKS:

1. Hazardous waste management CharlesA.Wentz.Second edition 1995.McGraw Hill nternational.
2. Hazardous waste management Michael D. La Gerga, PhilipL Buckingham, Jeffrey C. Evans, Second edition 2010.Waveland Press.

REFERENCE BOOKS:

1. Basic Hazardous waste management, “William C.Blackman.Jr”, Third Edition, 2001, Lewis Publishers
2. Integrated solid waste management George Techobanoglous, Hilary Theisen & Sammuel A.Vigil.

| OME104 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 | 1 | 2 | - | - |
| CO2 | 2 | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 | 1 | 2 | - | - |
| CO3 | 2 | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 | 1 | 2 | - | - |
| CO4 | 2 | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 | 1 | 2 | - | - |
| CO5 | 2 | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 | 1 | 2 | - | - |
| Average | 2 | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 | 1 | 2 | - | - |

UNIT- IV ENGINE CONTROL SYSTEMS**9**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles

UNIT- V CHASSIS AND SAFETY SYSTEMS**9**

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of air bag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able to

1. Know the importance of emission standards in automobiles.
2. Understand the electronic fuel injection and ignition components and their function.
3. Choose and use sensors and equipment for measuring mechanical quantities temperature and appropriate actuators.
4. Diagnose electronic engine control systems problems with appropriate diagnostic tools.
5. Analyze the chassis and vehicle safety system.

TEXTBOOKS:

1. Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier, Indian Reprint, 2017.
2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 7th edition, 2019.

REFERENCE BOOKS:

1. Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 4th edition, 2000.
2. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.

| OME105 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|----------|---|---|---|---|----|----------|----------|----------|----------|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 2 | - | - |
| CO2 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 2 | - | - |
| CO3 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 2 | - | - |
| CO4 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 2 | - | - |
| CO5 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 2 | - | - |
| Average | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 2 | - | - |

UNIT- IV ENERGY MATERIALS AND MOLECULAR ELECTRONICS 9

Electro chemical capacitor - super capacitors for energy storage - single junction solar cell-Tandem solar cell - Dye sensitized solar cells – Quantum dot solar cell - Organic solar cells – Semiconductor nanostructures. Superconductors for energy storage systems and transportation. Organic electronics- Organic LED – spintronics - dilute magnetic semiconductors.

UNIT- V BIO-INSPIRED MATERIALS 9

Bio-inspired materials, Classification, Biomimics, Spider Silk, Lotus Leaf, Gecko feet, Synovial fluid, 'Bionics' - Bio-inspired Information Technologies, Artificial Sensory Organs, Biomineralization-En route to Nanotechnology; Biometals – bioceramics- bio synthetic polymers.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. The students will gain knowledge on the basics of conducting polymer sensors, actuators and FET sensors.
2. The students will have adequate knowledge on the soft materials, and micro soft robotics.
3. The students will have knowledge on the concepts Magneto caloric effect, magnetic cooling and heating.
4. The students will understand the basics of Bio-inspired materials and Bio-inspired Information Technologies
5. The students will get knowledge on electro chemical capacitor and spintronics.

TEXTBOOKS:

1. Hasse Fredriksson, KTH Stockholm, Sweden and Ulla Åkerlind University of Stockholm, Sweden 'Physics of Functional Materials' John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, 2008.
2. S Banerjee, A.K. Tyagi, 'Functional Materials- Preparation, Processing and Applications' Elsevier , 2011.
3. Chander Prakash, Sunpreet Singh, J. Paulo Davim, 'Functional and Smart Materials',CRC Press ,2020.
4. Arcady Zhukov, 'Novel Functional Magnetic Materials- Fundamentals and Applications',Springer International Publishing, 2016.
5. Insup Noh, 'Biomimetic Medical Materials- From Nanotechnology to 3D Bioprinting', Springer Singapore, 2018.

REFERENCE BOOKS:

1. Quan Li , 'Photoactive Functional Soft Materials Preparation, Properties, and Applications'Wiley-VCH ,2019.
2. Hee-Gweon Woo, Hong Li, 'Advanced Functional Materials', Springer , 2011.
3. Rupitsch, Johann, S., Piezoelectric Sensors and Actuators. Springer-Verlag Berlin Heidelberg, 2018.
4. G. Arthanareeswaran, Pei Sean Goh, S. A. Gokula Krishnan , 'Functional Polymers and Nanomaterials for Emerging Membrane Applications',CRC Press ,2023.

| OPH101 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|-----|-----|---|-----|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 1 | 2 | - | - | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | - | - | - | | 1 | - | - | - | - |
| CO3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| CO5 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |
| Average | 3 | 1.8 | 1.6 | 1 | 1.5 | 1 | 1 | - | - | - | - | 1 | - | - | - | - |

UNIT- IV NANOCOMPOSITES

9

Introduction, the importance of nanocomposites, binary and ternary nanocomposites. Synthesis, properties and applications of metal-metal oxide and metal oxide-metal oxide nanocomposites, biodegradable polymer-based nanocomposites, thermoplastic nanocomposites, nylon-6 nanocomposites, clay polymer nanocomposites.

UNIT- V APPLICATIONS OF NANOMATERIALS

9

Introduction, applications of nanomaterials in renewable energy generation, drug delivery, cosmetics, tissue engineering, bioinformatics, nanomedicine, molecular motors, bioelectronics & spintronics, textiles, cosmetics, agriculture & food technology, high integrated circuits, information technology, defence and aerospace. Practice of nanoparticles for environmental remediation and water treatment.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

1. Evaluate and understand the different types of nanomaterials and their properties.
2. Understand the proper methods for synthesizing nanomaterials.
3. Recommend the characterization techniques for various nanomaterials.
4. Illustrate the functioning and properties of nanocomposites and their interference.
5. Develop a more profound knowledge on the applications of nanomaterials in various fields.

TEXTBOOKS:

1. C. N. R. Rao, Achim Muller, Anthony K. Cheetham, "The Chemistry of Nanomaterials: Synthesis, Properties and Applications", 2nd Edition Wiley-VCH, Germany, 2006.

2. Geoffrey A. Ozin, Andre C. Arsenault, Ludovico Cademartiri, Chad A. Mirkin, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2nd Edition, United Kingdom, 2008.
3. Azamal Husen, Khwaja Salahuddin Siddiqi, "Advances in Smart Nanomaterials and their Applications (Micro and Nano Technologies)", 1st Edition, Elsevier, Netherlands, 2023.

REFERENCE BOOKS:

1. William A Goddard "Handbook of Nanoscience, Engineering and Technology", 3rd Edition, CRC Taylor and Francis, United Kingdom, 2012.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press, London, 2004.
3. N. Kumar, "Concise concepts of nanoscience and nanomaterials", Scientific publishers, New Delhi, 2019.
4. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, Hyderabad, 2018.
5. Korada, Viswanatha Sharma, Hamid, Nor Hisham, Engineering Applications of Nanotechnology: From Energy to Drug Delivery, Springer, United States, 2017.

| OCH101 | PO | | | | | | | | | | | | PSO | | | | |
|----------------|----------|------------|------------|------------|------------|------------|----------|------------|----------|----------|----------|------------|----------|----------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | |
| CO1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| CO3 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| CO4 | 2 | 1 | 1 | 1 | - | 1 | - | 1 | - | - | - | 1 | - | - | - | - | - |
| CO5 | 2 | 1 | 1 | 1 | 1 | 1 | - | 1 | - | - | - | 1 | - | - | - | - | - |
| Average | 2 | 0.6 | 0.8 | 0.4 | 0.2 | 0.2 | - | 0.2 | - | - | - | 0.8 | - | - | - | - | - |

MINOR DEGREE COURSES

VERTICAL 1: FINTECH AND BLOCK CHAIN

| | | | | | |
|---------------|-----------------------------|----------|----------|----------|----------|
| BAM101 | FINANCIAL MANAGEMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To acquire the knowledge of the decision areas in finance.
- To learn the various sources of Finance.
- To describe about capital budgeting and cost of capital.
- To discuss on how to construct a robust capital structure and dividend policy.
- To develop an understanding of tools on Working Capital Management.

UNIT- I INTRODUCTION TO FINANCIAL MANGEMENT 9

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of Money-Risk and return concepts.

UNIT- II SOURCES OF FINANCE 9

Long term sources of Finance-Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits etc.

UNIT- III INVESTMENT DECISIONS 9

Investment Decisions: Capital budgeting – Need and Importance –Techniques of Capital Budgeting - Payback - ARR – NPV – IRR – Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock - Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT- IV FINANCING AND DIVIDEND DECISION 9

Capital Structure – determinants of Capital structure- Designing an Optimum capital structure. Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - Determinants of Dividend Policy.

UNIT- V WORKING CAPITAL DECISION

9

Working Capital Management: Working Capital Management - concepts - importance -Determinants of Working capital - Working capital operating cycle. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will have an understanding on Time value of money and role of a finance manager.
2. Students will be able to analyze the various avenues available to generate long term funds for investments through capital markets and other sources.
3. Students will be able to apply various techniques for Investment decisions.
4. Students will be able to choose the right approach for financing and dividend decisions to solve business issues.
5. Students will be able to analyze the requirement and management of working capital.

REFERENCE BOOKS:

1. M.Y. Khan and P.K. Jain Financial Management, text, problems and cases Tata McGraw Hill, 8th edition 2017.
2. I.M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 11th edition, 2018.
3. Prasanna Chandra, Financial Management – Theory and Practice, 9th edition, Tata McGraw Hill, 2017.
4. Rajiv Srivastava and Anil Misra Financial Management, Oxford University Press, 2011.
5. Parasuraman, N.R Financial Management: a step-by-step approach, 2nd edition; Cengage Learning India Pvt. Ltd., 2019.

| | | | | | |
|---------------|-----------------------------------|----------|----------|----------|----------|
| BAM102 | FUNDAMENTALS OF INVESTMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To describe the investment environment and understand the factors influencing investment decisions.
- To explain the methods of valuing bonds and equities.
- To examine various approaches used in the valuation of securities.
- To understand the principles of portfolio construction and the role of diversification in creating efficient portfolios.
- To discuss the mechanisms of investor protection in India, including regulatory frameworks and investor rights.

UNIT- I THE INVESTMENT ENVIRONMENT 9

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

UNIT- II FIXED INCOME SECURITIES 9

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating. Yield Measures: Current Yield, Yield to Maturity (YTM), Yield to Call (YTC) Money Market Instruments (Treasury Bills, Certificates of Deposit, Commercial Paper). Credit Rating Agencies in India (CRISIL, ICRA, CARE, India Ratings).

UNIT- III APPROACHES TO EQUITY ANALYSIS 9

Introduction to Fundamental Analysis, Technical, Analyze macroeconomic indicators: GDP, interest rates, inflation, etc. Sector and industry analysis (Porter's Five Forces). Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT- IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES 9

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

UNIT- V INVESTOR PROTECTION

9

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism. Concept of Fair Disclosure and Transparency. Sustainable Investing and ESG.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will understand basic investment concepts and their significance, and analyze various investment avenues including stocks, bonds, mutual funds, real estate, commodities, and financial derivatives.
2. Students will evaluate risk and return profiles of different investment options using appropriate tools and techniques, and interpret market trends and economic indicators to make informed investment decisions.
3. Students will be able to apply principles of portfolio construction and management to optimize investment returns.
4. Students can able to develop a long-term investment strategy aligned with financial goals and risk appetite.
5. Students can able to explain the regulatory framework for investor protection in India and the principles of sustainable and ethical investing.

REFERENCE BOOKS:

1. Pinto, J. E., Henry, E., Robinson, T. R., & Stowe, J. D. Equity Asset Valuation (4th ed.). Wiley India 2023.
2. Chandra, P. Fundamentals of Investment (Revised ed.). McGraw-Hill Education 2022.
3. Mishkin, F. S., & Eakins, S. G. Financial Markets and Institutions (9th ed., Indian adaptation by Aparna Pujari 2021.
4. Sundaresan, S. Fixed Income Securities (4th ed.). McGraw-Hill Education 2021.

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|---------------|--|----------|----------|----------|----------|
| BAM103 | BANKING, FINANCIAL SERVICES AND INSURANCE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the Banking system in India.
- To grasp how banks, raise their sources and how they deploy it.
- To understand the development in banking technology.
- To understand the financial services in India.
- To understand the insurance Industry in India.

UNIT- I INTRODUCTION TO INDIAN BANKING SYSTEM 9

Overview of Banking system–Structure– Functions–Banking system in India – Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT- II MANAGING BANK FUNDS / PRODUCTS 9

Liquid Assets - Investment in securities - Advances - Loans. Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes. Designing deposit schemes – Asset and Liability Management – NPA's – Current issues on NPA's – M&A's of banks into securities market

UNIT- III DEVELOPMENT IN BANKING TECHNOLOGY 9

Payment system in India – paper based – e payment –electronic banking –plastic money – e-money –forecasting of cash demand at ATM's –The Information Technology Act, 2000 in India – RBI's Financial Sector Technology vision document – security threats in e-banking & RBI's Initiative.

UNIT- IV FINANCIAL SERVICES 9

Introduction – Need for Financial Services – Financial Services Market in India – NBFC — Leasing and Hire Purchase — mutual funds. Venture Capital Financing – Bill discounting –factoring – Merchant Banking.

UNIT- V INSURANCE

9

Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 –IRDA – Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival – settlement of claim.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will be able to identify and describe the roles and interrelationship of institutions in the banking, financial services, and insurance sectors.
2. Students will understand key functions such as deposits, loans, credit creation, and payment systems in both commercial and central banking.
3. Students will analyze various products such as savings accounts, fixed deposits, mutual funds, credit cards, and insurance policies.
4. Students will demonstrate an understanding of the regulatory environment, including acts, guidelines, and the roles of RBI, SEBI, IRDAI, etc.
5. Students will assess the impact of digital banking, and e-insurance services on customer experience and operational efficiency.

REFERENCE BOOKS:

1. Padmalatha Suresh and Justin Paul, “Management of Banking and Financial Services, Pearson, Delhi, 2017.
2. Meera Sharma, “Management of Financial Institutions – with emphasis on Bank and Risk Management”, PHI Learning Pvt. Ltd., New Delhi 2010.
3. Peter S.Rose and Sylvia C. and Hudgins, “Bank Management and Financial Services”, Tata McGraw Hill, New Delhi, 2017.
4. Indian Financial System M. Y. Khan, McGraw Hill Education, 2019 10th Edition.
5. Financial Markets and Institutions, L. M. Bhole & Jitendra Mahakud, McGraw Hill Education, 2021 6th Edition.

| | | | | | |
|---------------|---|----------|----------|----------|----------|
| CSM101 | INTRODUCTION TO BLOCK CHAIN AND ITS APPLICATIONS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand Blockchain's fundamental components, and examine decentralization using blockchain.
- To explain how cryptocurrency works, from when a transaction is created to when it is considered part of the Blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To study the basics of Hyperledger and Web3.
- To know about alternative Blockchains and Blockchain projects in different domains.

UNIT- I INTRODUCTION TO BLOCKCHAIN 9

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

UNIT- II INTRODUCTION TO CRYPTOCURRENCY 9

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.

UNIT- III ETHEREUM 9

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

UNIT- IV WEB3 AND HYPERLEDGER 9

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture –

Hyperledger Fabric – Distributed Ledger – Corda.

UNIT- V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING 9
TRENDS

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

1. Understand the technology components of Blockchain and how it works behind the scenes.
2. Understand Bitcoin and its limitations by comparing with other alternative coins.
3. Devise solution using the Ethereum model.
4. Understand and use Hyperledger and its development framework.
5. Track alternative Blockchains and emerging trends in Blockchain.

TEXTBOOKS:

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madiseti, “Blockchain Applications: A Hands on Approach”, VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O’Reilly, 2014.
3. Roger Wattenhofer, “The Science of the Blockchain” CreateSpace Independent Publishing, 2016.
4. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
5. Alex Leverington, “Ethereum Programming” Packt Publishing, 2017.

| CSM101 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | - | - | 1 | - | - | 3 | - | - | 1 | - | - | 3 | - | - | - |
| CO2 | - | 3 | 3 | - | - | - | - | 3 | 3 | - | - | - | - | 3 | - | - |
| CO3 | - | - | 3 | 1 | - | - | - | - | 3 | 1 | - | - | - | - | 3 | - |
| CO4 | 3 | - | - | - | - | - | 3 | - | - | - | - | - | 1 | 1 | - | - |
| CO5 | - | - | - | - | 3 | - | - | - | - | - | 3 | - | 2 | 3 | 1 | 3 |
| Average | 3 | 3 | 3 | 1 | 3 | - | 3 | 3 | 3 | 1 | 3 | - | 2 | 2.3 | 2 | 3 |

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|---------------|--|----------|----------|----------|----------|
| BAM104 | FINTECH PERSONAL FINANCE AND PAYMENTS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To introduce the foundational concepts of Financial Technology (FinTech) and its applications in personal finance, inclusive finance, and digital financial services.
- To familiarize students with digital payment systems and cryptocurrencies, including their underlying technologies, security concerns, and legal frameworks.
- To provide insights into InsurTech innovations, focusing on the integration of AI, ML, and IoT in risk management, underwriting, and fraud detection in insurance.
- To enable understanding of peer-to-peer lending models and crowdfunding ecosystems, with a focus on digital infrastructure and financing solutions for SMEs and MSMEs.
- To develop awareness of global and domestic FinTech regulations, and the emergence of RegTech as a tool for ensuring regulatory compliance and fraud monitoring using AI.

UNIT- I INTRODUCTION TO FINTECH AND DIGITAL FINANCE 9

Overview of FinTech: Definition, scope, applications. History of Financial Innovation and Digitization. Alternative Finance: Crowdfunding – Types (Charity, Equity), platforms. Introduction to Initial Coin Offering (ICO). Role of FinTech in personal finance and inclusive finance.

UNIT- II DIGITAL PAYMENTS AND CRYPTOCURRENCIES 9

Introduction to Cryptocurrencies: Bitcoin and Applications. Types of Cryptocurrencies and Digital Wallets. Basics of Blockchain Technology. National Payment Systems: Real-Time Gross Settlement (RTGS), Immediate Payment Service (IMPS), Unified Payments Interface (UPI). Digital Payments: Smart Cards, Mobile Payments, Payment Gateways, Virtual Currencies. Legal, Security, Privacy, and Ethical Issues in Digital Transactions.

UNIT- III INSURTECH AND DIGITAL INSURANCE INNOVATIONS 9

Introduction to InsurTech. Role of (Artificial Intelligence (AI), Machine Language (ML), and Internet of Things (IoT) in insurance services. Risk Modelling, Fraud Detection. Innovations in Claims Processing and Underwriting. Impact on traditional insurance business models.

UNIT- IV P2P LENDING AND FINANCIAL INCLUSION 9

Peer-to-Peer (P2P) and Marketplace Lending. Architecture and Technology Platforms. Crowdfunding Unicorns and Business Models. Financing for SME/MSME – Opportunities, Challenges, and FinTech Solutions.

UNIT- V FINTECH REGULATIONS AND REGTECH 9

Global and Indian FinTech Regulations. Legal and Regulatory Risks. RegTech: Definition, Evolution. RegTech Ecosystem – Institutions, Startups, Regulators. Role of AI in Compliance and Fraud Monitoring.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students can able to explain the fundamentals of cryptocurrencies, digital wallets, blockchain and payment systems such as UPI, RTGS, and IMPS, along with related security and regulatory aspects.
2. Students will describe the evolution of digital finance and analyze alternative finance models like crowdfunding and Initial Coin Offerings (ICO).
3. Students will evaluate the role of AI, ML, and IoT in InsurTech applications such as underwriting, claims processing, risk modeling, and fraud detection.
4. Students will analyze P2P lending and crowdfunding platforms, infrastructure, and innovations for SME/MSME financing.
5. Students will interpret FinTech regulations and assess the role of RegTech and AI in ensuring compliance and detecting fraud.

REFERENCE BOOKS:

1. Swanson, Seth Fintech for Beginners: Understanding and Utilizing the Power of Technology. Create Space Independent Publishing Platform 2016.
2. Tanda, Alessandra & Schena, Cristiana-Maria FinTech, BigTech and Banks: Digitalisation and Its Impact on Banking Business Models. Springer 2019.
3. Diedrich, Henning Ethereum : Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations. Wildfire Publishing 2016.
4. William, Jacob Fin Tech: The Beginner's Guide to Financial Technology. Create Space Independent Publishing Platform 2016.
5. Indian Institute of Banking and Finance (IIBF) Digital Banking. Taxmann Publications 2016.

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|---------------|--------------------------------|----------|----------|----------|----------|
| BAM105 | INTRODUCTION TO FINTECH | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn about history, importance and evolution of Fintech
- To acquire the knowledge of Fintech in payment industry
- To acquire the knowledge of Fintech in insurance industry
- To learn the Fintech developments around the world
- To know about the future of Fintech

UNIT- I INTRODUCTION 9

Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.

UNIT- II PAYMENT INDUSTRY 9

FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT- III INSURANCE INDUSTRY 9

FinTech in Wealth Management Industry-Financial Advice, Automated investing, Socially responsible investing, Fractional Investing, Social Investing. FinTech in Insurance Industry- P2P insurance, On- Demand Insurance, On-Demand Consultation, Customer engagement through Quote to sell, policy servicing, Claims Management, Investment linked health insurance.

UNIT- IV FINTECH AROUND THE GLOBE 9

FinTech developments - US, Europe and UK, Germany, Sweden, France, China, India, Africa, Australia, New Zealand, Brazil and Middle East, Regulatory and Policy Assessment for Growth of FinTech. FinTech as disruptors, Financial

institutions collaborating with FinTech companies, The new financial world.

UNIT- V FUTURE OF FINTECH

9

How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students can able to understand and describe the historical phases of FinTech.
2. Students can able to recognize how FinTech is revolutionizing payments, lending, wealth tech, insurance, and emerging sectors across different regions.
3. Students can able to understand the nuances of fintech in wealth management industry.
4. Students can able to compare major FinTech hubs and understand strategic collaborations between traditional financial institutions and tech firms.
5. Students will understand the future of fintech.

REFERENCE BOOKS:

1. Arner D., Barberis J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015.
2. Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016.
3. Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016.
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018.
5. Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications,2020.

VERTICAL 2: ENTREPRENEURSHIP

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| BAM201 | FOUNDATIONS OF ENTREPRENEURSHIP | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
- To empower the learners to run a Technology driven business efficiently and effectively.
- To cultivate entrepreneurial skills, increase awareness of entrepreneurship, and foster a culture of innovation and job creation.

UNIT- I INTRODUCTION TO ENTREPRENEURSHIP 9

Entrepreneurship- Definition, Need, Scope -Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Barriers to Entrepreneurship– Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

UNIT- II BUSINESS OWNERSHIP & ENVIRONMENT 9

Types of Business Ownership – Business Environmental Factors – Political-Economic-Sociological- Technological-Environmental-Legal aspects – Human Resources Mobilisation-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration.

UNIT- III FUNDAMENTALS OF TECHNOPRENEURSHIP 9

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts - Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends-

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| BAM202 | TEAM BUILDING AND LEADERSHIP | L | T | P | C |
| | MANAGEMENT FOR BUSINESS | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To develop and strengthen the Leadership qualities and motivation of learners.
- To impart the Leadership skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of Team Building in managing Technology oriented businesses.
- To empower the learners to build robust teams for running and leading a business efficiently and effectively.
- To emphasize the importance of ethics and values in leadership practices.

UNIT- I INTRODUCTION TO MANAGING TEAMS 9

Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development – Enhancing team work with in a group – Team Coaching-Team Decision Making-Virtual Teams-Self Directed Work Teams (SDWTs) -Multicultural Teams.

UNIT- II MANAGING AND DEVELOPING EFFECTIVE TEAMS 9

Team-based Organisations- Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High- Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT- III INTRODUCTION TO LEADERSHIP 9

Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation – Effective Communication in Leadership - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

UNIT- IV LEADERSHIP IN ORGANISATIONS 9

Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model - Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership – Change Management - Role of Ethics and Values in Organisational Leadership.

UNIT- V LEADERSHIP EFFECTIVENESS 9

Leadership Behaviour - Assessment of Leadership Behaviors - Destructive Leadership - Motivation and Leadership – Motivation and Employee Engagement - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will learn the basics of managing teams for business.
2. Students will understand developing effective teams for business management.
3. Students will understand the fundamentals of leadership for running a business.
4. Students will learn about the importance of leadership for business development.
5. Students will acquaint with emerging trends in leadership effectiveness for entrepreneurs.

REFERENCE BOOKS:

1. "Leadership and Team Building" by Uday Kumar Haldar, First Edition, Oxford University Press, New Delhi 2010.
2. "The Five Dysfunctions of a Team: A Leadership Fable" by Patrick Lencioni, 20th Anniversary Edition, Jossey-Bass 2002.
3. Hughes, R.L, Ginnett, R.C., & Curphy, G.J., Leadership: Enhancing the lessons of experience, 9th Ed, McGraw Hill Education, Chennai, India. 2019.
4. Katzenback, J.R., Smith,D.K., The Wisdom of Teams: Creating the High Performance Organisations, Harvard Business Review Press, 2015.
5. Haldar, U.K., Leadership and Team Building, Oxford University Press, 2010.

Pull/Market Push – Product -Market fit

UNIT- V INNOVATIVE BUSINESS MODELS

9

Innovative Business Models: Customer Discovery-Customer Segments-Prospect Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models –Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will learn the basics of creativity for developing Entrepreneurship.
2. Students will understand the importance of creative intelligence for business growth.
3. Students will understand the advances through Innovation in Industries.
4. Students will learn about applications of innovation in building successful ventures.
5. Students will acquaint with developing innovative business models to run the business efficiently and effectively.

REFERENCE BOOKS:

1. Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand & Sons, 2021.
2. Innovation Management, C.S.G. Krishnama charyulu, R. Lalitha, Himalaya Publishing House, 2nd edition, 2017.
3. Paul Trott, Innovation Management and New Product Development, 4e, Pearson, 2018.
4. A. Dale Timpe, Creativity, Jaico Publishing House, 2003. Brian Clegg, Paul Birch, Creativity, Kogan Page, 2009.
5. Tidd, J., & Bessant, J. Managing innovation: Integrating technological, market and organizational change. UK: Wiley 2020.

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| BAM204 | PRINCIPLES OF MARKETING MANAGEMENT | L | T | P | C |
| | FOR BUSINESS | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To provide basic knowledge of concepts, principles, tools and techniques of marketing for entrepreneurs
- To provide an exposure to the students pertaining to the nature and Scope of marketing, which they are expected to possess when they enter the industry as practitioners.
- To give them an understanding of fundamental premise underlying market driven strategies and the basic philosophies and tools of marketing management for business owners.
- To consider the various decision areas within marketing and the tools and methods used by marketing managers for making decisions.
- To appreciate how a marketing perspective is important in your own personal and professional development.

UNIT- I INTRODUCTION TO MARKETING MANAGEMENT 9

Introduction-Market and Marketing – Concepts – Functions of Marketing - Importance of Marketing Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix The Additional 3Ps - Developing an Effective Marketing Mix.

UNIT- II MARKETING ENVIRONMENT 9

Introduction-Environmental Scanning- Analysing the Organisation's Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.

UNIT- III PRODUCT AND PRICING MANAGEMENT 9

Product-Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding

Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies - National and Global Pricing.

UNIT- IV PROMOTION AND DISTRIBUTION MANAGEMENT 9

Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) – Introduction to Advertising and Sales Promotion –Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)-Logistics Management- Introduction to Retailing and Wholesaling.

UNIT- V CONTEMPORARY ISSUES IN MARKETING MANAGEMENT 9

Introduction - Relationship Marketing vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing, E-Marketing or Online Marketing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will have the awareness of marketing management process.
2. Students will understand the marketing environment.
3. Students will acquaint about product and pricing strategies.
4. Students will have the knowledge of promotion and distribution in marketing management.
5. Students can comprehend the contemporary marketing scenarios and offer solutions to marketing issues.

REFERENCE BOOKS:

1. Marketing Management, Sherlekar S.A, Himalaya Publishing House,2016.
2. Marketing Management, Philip Kotler and Kevin Lane Keller, PHI 15th Ed, 2015.
3. Marketing Management-An Indian perspective, Vijay Prakash Anand, Biztantra, Second edition, 2016.

4. Marketing Management Global Perspective, Indian Context, V.S.Ramaswamy & S.Namakumari, Macmillan Publishers India, 5th edition, 2015.
5. Marketing Management, S.H.H. Kazmi, 2013, Excel Books India.

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| BAM205 | HUMAN RESOURCE MANAGEMENT | L | T | P | C |
| | FOR ENTREPRENEURS | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To introduce the basic concepts, structure and functions of human resource management for entrepreneurs.
- To create an awareness of the roles, functions and functioning of human resource department.
- To understand the methods and techniques followed by Human Resource Management practitioners.
- To understand the training and compensation practices in Industry
- To create an awareness on controlling measures followed HR practitioners.

UNIT- I INTRODUCTION TO HRM 9

Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting – HR Audit - Challenges in HRM.

UNIT- II HUMAN RESOURCE PLANNING 9

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT- III RECRUITMENT AND SELECTION 9

Sources of recruitment - Internal Vs. External - Domestic Vs. Global Sources – e Recruitment - Selection Process- Selection techniques -E-Selection- Interview Types - Employee Engagement.

UNIT- IV TRAINING AND EMPLOYEE DEVELOPMENT 9

Types of Training – On –The – Job, Off – The - Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

UNIT- V CONTROLLING HUMAN RESOURCES**9**

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods- Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment – Union - Management Relationship - Recent Trends

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

1. Students will understand the Evolution of HRM and Challenges faced by HR Managers.
2. Students will learn about the HR Planning Methods and practices.
3. Students will acquaint about the Recruitment and Selection Techniques followed in Industries.
4. Students will know about the methods of Training and Employee Development.
5. Students will comprehend the techniques of controlling human resources in organisations.

REFERENCE BOOKS:

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14e, Pearson, 2015.
2. David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014.
3. Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017.
4. R. Wayne Mondy, Human Resource Management, Pearson, 2015.
5. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012.

Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding - Venture Capital - Venture Valuation - meaning and Basic Mechanics of Valuation.

UNIT- V METHODS OF FUND RAISING FOR NEW VENTURES 9

Investor Decision Process - Identifying the appropriate investors - Targeting investors - Building Investor Relationships - Investor Selection Criteria - Company Creation-Raising Funds - Seed Funding - VC Selection Criteria – Process – Methods - VC Investment Process in India - Recent Trends.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will learn the basics of starting a new business venture.
2. Students can identify various venture financing opportunities
3. Students will understand the sources of debt financing.
4. Students will understand the sources of equity financing.
5. Students will acquaint and Formulate strategies for effective fundraising in real-world scenarios.

REFERENCE BOOKS:

1. Chandra, P. Projects: Planning, analysis, financing, implementation, and review (8th ed.). McGraw Hill Education, 2017.
2. Ramsinghani, M., The business of venture capital: The art of raising a fund, structuring investments, portfolio management, and exits (3rd ed.). Wiley. 2021.
3. Prasanna Chandra, Projects planning, Analysis, Selection, Financing, Implementation and Review, McGraw Hill Education India Pvt Ltd, New Delhi, 2019.
4. Byers, Thomas. Technology Ventures: From Idea to Enterprise. McGraw – Hill Higher Education, 2014.
5. Steven Rogers, Entrepreneurial Finance: Finance and Business Strategies for the Serious Entrepreneur 3e, Tata Mc Graw Hill, 2014.

VERTICAL 3: PUBLIC ADMINISTRATION

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| BAM301 | PRINCIPLES OF PUBLIC ADMINISTRATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the nature, scope and essentials of Public Administration administrative theories and concepts to make sense of administrative practices.
- To evaluate the changing paradigms of Public Administration.
- To understand the synthesizing knowledge of public administration from public perspective.
- To study and explore the approaches of administrative process.
- To cover the principles, practices and the impact of public administration on society.

UNIT- I INTRODUCTION TO PUBLIC ADMINISTRATION 9

Meaning- Nature and Scope of Public Administration, Evolution of Public Administration, Public Administration and Private Administration, Public Administration –Arts, Science or both, Public Administration - relations to other social sciences, Importance of Public Administration.

UNIT- II EMERGING TRENDS IN PUBLIC ADMINISTRATION 9

New Public Administration–Formulating the structure, New Public Management, Globalization and Public Administration, Paradigm Shift from Government to Governance.

UNIT- III ADMINISTRATIVE ORGANIZATIONS 9

Forms of Administrative Organizations –Departments, Public Corporations, Public sector undertakings, Independent Regulatory Commissions, Line and Staff Agencies, Administrative Tribunal.

UNIT- IV APPROACHES AND THEORIES OF PUBLIC ADMINISTRATION 9

Classical Approach, Administrative Approach, Scientific Management Approach,

Bureaucratic Approach, Human Relations Approach, Ecological Approach.

UNIT- V PRINCIPLES AND PRACTICES OF PUBLIC ADMINISTRATION 9

Chief Executive - Meaning, Types, Functions & Qualities of Chief Executive, Supervision, Communication - meaning, types of communication & its importance in Public Administration, Centralization & Decentralization, Public Relation, Meaning, Methods & Significance, Decision making - Types, Techniques and Processes, Leadership - Styles –Approaches.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will understand public administration theory and concepts from multiple perspectives.
2. Students will appreciate the nature, scope and dynamics of Public Administration.
3. Students will acquaint with India's development experience and changing role of administration practices.
4. Students will grasp the administrative theories, concepts and principles to make sense of administration in the developing era.
5. Students will demonstrate the integrative knowledge, skills and ethics necessary for responsible Administrative, management and leadership positions.

REFERENCE BOOKS:

1. Lakshmi Kanth , Public Administration by McGraw Hill, 2018.
2. Rosenbloom David, Public Administration: Understanding Management, Politics, and Law in the Public Sector, McGraw Hill, 2018.
3. Avasthi and Maheswari: Public Administration in India, Agra:Lakshmi Narain Agarwal, 2013.
4. Ramesh K Arora: Indian Public Administration, New Delhi: Wishwa Prakashan, 2012.
5. R.B. Jain: Public Administration in India,21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.

UNIT- III THE STATE GOVERNMENT, UNION TERRITORIES STATE 9
LEGISLATURE

Madras Presidency to Tamil Nadu – Tamil Nadu Emblem. State Executives – His Excellency “The Governor” Power & Functions, Chief Minister – Power & Functions, State Cabinet, Members of Legislative Assembly Role. Union Territories – Power & Functions. Federal System, Centre-State Relations. High Court & Subordinate Courts- Lok Adalat 1982 Vs Arbitration Tribunal.

UNIT- IV LOCAL ADMINISTRATION 9

Corporation – Mayor, Chairman District Administration Head - Role and Importance, Role of Elected Representative – Pachayati Raj: Functions PRI – Grama Sabha. Block level Organizational Hierarchy, Village level - Role of Elected and Appointed officials - Importance of grass-root democracy.

UNIT- V ELECTION SYSTEMS AND E-GOVERNANCE 9

Election Commission: Role of Chief Election Commissioner - State Election Commission – One India One Election. National Good Governance Day - Governance and role of Engineers in E-Governance, Need for reformed engineering serving at the Centre and State, E- Courts, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

1. Students will identify and explore the basic features and modalities about Indian constitution.
2. Students will differentiate and relate the functioning of 3 wings of India.
3. Students will understand the state level executives and state courts
4. Students will identify the role of Mayor and elected representatives of Municipalities
5. Students will know the role of Election Commission apply knowledge and E-governance.

REFERENCE BOOKS:

1. BR. Ambedkar, Rupa Publications. The Constitution of India. Rupa Publications. 2024.
2. Singh, M. P. (Ed.). EBC's V. N. Shukla's Constitution of India (14th ed., reprint 2024). Eastern Book Company.
3. Bakshi, P. M The Constitution of India (19th ed.). Universal Law Publishing (LexisNexis) 2023.
4. Babu, D. D. Introduction to the Constitution of India (27th ed.). Lexis Nexis 2024.
5. Sharma, B. K. Introduction to the Constitution of India (11th ed.). PHI Learning 2024.

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| BAM303 | PUBLIC PERSONNEL ADMINISTRATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the fundamental principles, scope, and evolution of Public Personnel Administration.
- To analyze different types of personnel systems and their relevance in democratic governance.
- To examine the processes of recruitment, training and promotion within the public sector.
- To gain insights into the structure and functioning of All India Services and State Public Service Commissions.
- To evaluate employer-employee relations, wage systems and benefits in the context of public sector employment.

UNIT- I INTRODUCTION TO PERSONNEL ADMINISTRATION 9

Meaning, Scope and Importance of Personnel Administration - Evolution of Public Personnel Administration-Personnel Administration vs. Human Resource Management – Challenges in Personnel Administration – Types of Personnel Systems Bureaucratic, Democratic and Representative systems- Emerging Trends in Personnel Administration.

UNIT- II PERSONNEL SYSTEMS AND ADMINISTRATIVE ETHICS 9

Generalist Vs Specialist – Comparative Analysis of Personnel Systems – Role of Civil Servants in Policy Implementation - Relationship between Civil Servants and Political Executives - Mechanisms for Promoting Administrative Accountability- Civil Servant’s Relationship with Political Executive – Ethics and Integrity in Administration - Mechanisms for Promoting Administrative Accountability.

UNIT- III RECRUITMENT, TRAINING AND PROMOTION 9

Recruitment: Direct Recruitment and Recruitment from Within – Methods of Manpower Planning- Training: Objectives and Need –Types of Training: Induction,

In-service, Orientation, Refresher - Performance Appraisal and Merit-based Promotion – Promotion.

UNIT- IV PUBLIC SERVICE FRAMEWORK IN INDIA 9

All India Services – Structure and Cadre Management – Rules and Regulations Governing Service Conditions – Code of Conduct and Disciplinary Actions –State Public Service Commissions: Functions and Autonomy - UPSC and Its Constitutional Mandate - Reservation Policy in Services - Gender Sensitization and Inclusivity in Services.

UNIT- V EMPLOYEE RELATIONS AND COMPENSATIONS 9

Employer Employee Relations – Wage Theories and Compensation Models – Principles of Pay Fixation - Salary Structures in Indian Civil Services – Salary Structures in Indian Civil Services – Social Security Benefits and Retirement Schemes - Wage and Salary Administration – Allowances and Benefits.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

1. Students will demonstrate a comprehensive understanding of the nature, scope, and importance of public personnel administration.
2. Students will be able to distinguish between bureaucratic, democratic, and representative personnel systems in public administration.
3. Students will apply knowledge of recruitment, training and promotion practices to real-world administrative scenarios.
4. Students will critically analyze the structure and functioning of the All India Services and State Public Service Commissions.
5. Students will evaluate wage and salary administration, allowances and employee relations within the framework of public sector employment.

REFERENCE BOOKS:

1. Public Personnel Administration, 6th Ed, by David H. Rosenbloom, Robert S. Kravchuk, Richard M. Clerkin 2015.
2. Personnel Management in Government, 7th Ed, by R. Wayne Boss 2016.

3. Human Resource Management in Public Service, 5th Ed, by Richard C. Kearney, Jerrell D. Cogburn 2015.
4. Public Administration: An Introduction, 12th Ed, by David H. Rosenbloom, Robert S. Kravchuk, Richard M. Clerkin 2019.
5. Public Personnel Management, 4th Ed, by Donald E. Klingner, John Nalbandian 2018.

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| BAM304 | ADMINISTRATIVE THEORIES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To introduce students to the evolution of administrative thought
- To study the contributions of key administrative thinkers
- To develop an understanding of leadership, governance, and management principles
- To relate classical theories to contemporary administrative practices
- To enhance analytical and critical thinking skills

UNIT- I INTRODUCTION TO PUBLIC ADMINISTRATION 9

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration. Public Administration - Introduction, Principles of Organization and Management, Public Policy and Governance, Administrative Structure in India, Ethics and Accountability in Public Administration, Technology and Public Administration, Contemporary Issues in Public Administration.

UNIT- II THEORIES OF ORGANIZATION 9

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory. Introduction to Organizations, Neo-Classical Theories, Modern Theories, Contemporary Approaches, Organization Design and Structure, Leadership and Motivation in Organizations, Applications to Modern Industry and Technology.

UNIT- III ORGANIZATIONAL BEHAVIOUR AND DESIGN 9

Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design. Organizational Behaviour - Introduction, Individual Behaviour in Organizations, Group Behaviour and Team Dynamics, Leadership and Power, Conflict and Negotiation, Organizational Culture and Climate, Organizational

2. "Public Administration Theories & Principles" (Vidya R., Rajaram), Kindle 2024 Edition.
3. Fernando Lunenburg & Allen Irby – included in Development of Administrative Theory, SAGE Publications 2022.
4. Global Encyclopedia of Public Administration, Public Policy, and Governance. Springer Publications, 2nd Edition, 2020.
5. Administrative Theories: Approaches, Concepts and Thinkers in Public Administration, Rakesh Hooja, Ramesh K Arora 2007.

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| BAM305 | INDIAN ADMINISTRATIVE SYSTEM | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the historical evolution and constitutional framework of Indian administration.
- To analyze the role and functioning of key constitutional authorities and administrative institutions.
- To explore the structure, functions, and challenges of local governance and grassroots administration.
- To examine the impact of coalition politics and the role of ethics in administrative integrity
- To evaluate the mechanisms for corruption control, including Ombudsman, Lokpal & Lok Ayukta.

UNIT- I INTRODUCTION TO INDIAN ADMINISTRATION 9

Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India, Separation of powers and checks & balances in governance.

UNIT- II LOCAL GOVERNMENT AND ADMINISTRATION 9

Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government, Role of Smart Cities & Urban Local Bodies in governance.

UNIT- III CONSTITUTIONAL AMENDMENTS 9

Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992, Implementation challenges and

Publications India Pvt, Ltd. First edition,2019.

4. Khera. S.S : Administration in India – Asia Publishing House, Bombay, First edition,1964.
5. Ramesh K. Arora : Indian Public Administration - New Age International Publishers, Fourth edition, 2022.

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| BAM306 | PUBLIC POLICY ADMINISTRATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To provide students with a comprehensive understanding of the meaning, nature, scope, and significance of public policy.
- To equip students with knowledge of various approaches to policy analysis and familiarize them with key models such as Dror's Optimal Model.
- To enable students to understand the stages of the policy-making process, including formulation, implementation, and evaluation.
- To analyze the role of institutions, bureaucracy, interest groups, and political parties in the public policy process.
- To introduce students to significant public policies in India, such as the New Economic Policy, Population Policy, Agricultural Policy, and Information Technology Policy.

UNIT- I INTRODUCTION TO PUBLIC POLICY 9

Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Public policy relationship with social sciences especially with political science and Public Administration – Importance and relevance of public policy in modern society.

UNIT- II POLICY APPROACHES 9

Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System's Approach – Dror's Optimal Model- Comparison of different approaches.

UNIT- III POLICY FRAMEWORK 9

Major stages involved in Policy making Process – Policy Formulation – Policy Implementation – Policy Evaluation – Feedback mechanism and Policy change.

UNIT- IV ROLE OF POLITICS IN POLICY FRAMEWORK 9

Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties – Role of Judiciary.

Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy – Digital India Initiative.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

1. Students can able to know the importance of public policy and its interdisciplinary connections, especially with political science and public administration.
2. Students can able to assess different approaches and models used in policy analysis, including institutional, incremental, systems approaches, and Dror's Optimal Model.
3. Students will understand the stages involved in the policy-making process, from formulation through to evaluation.
4. Students can able to analyze the institutional framework and the roles played by bureaucracy, political parties, and interest groups in policy-making.
5. Students can able to evaluate the key public policies in India, understanding their context, objectives, and impacts.

REFERENCE BOOKS:

1. Anderson, J. E., Moyer, J., & Chichirau, G. Public Policymaking: An Introduction (9th ed.). New Delhi, India: Cengage India 2023.
2. Bardach, E., & Patashnik, E. M. A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving (7th ed.). Washington, DC: CQ Press 2023.
3. Cairney, P. Understanding Public Policy: Theories and Issues (2nd ed.). London: Bloomsbury Academic 2024.
4. Kraft, M. E., & Furlong, S. R. (Public Policy: Politics, Analysis, and Alternatives (8th ed.). Thousand Oaks, CA: CQ Press 2023.
5. Smith, K. B., & Larimer, C. W. The Public Policy Theory Primer (3rd ed.). New York, NY: Routledge 2017.

UNIT- III TESTING OF HYPOTHESIS - PARAMETRIC TESTS 9

Introduction to Hypothesis Testing - Definition and Importance of Hypothesis Testing in Engineering and Business, Basic Concepts: Null Hypothesis (H_0), Alternative Hypothesis (H_1), Type I and Type II Errors, Significance Level (α) and Power of a Test, p-Value: Concept and Interpretation. Parametric Tests for Mean (t-test), Parametric Tests for Proportions (Z-test), Analysis of Variance (ANOVA).

UNIT- IV TESTING OF HYPOTHESIS - NON-PARAMETRIC TESTS 9

Introduction to Non-Parametric Tests, Differences Between Parametric and Non-Parametric Tests, Sign Test (Concept of the Sign Test for One-Sample Data), Mann-Whitney U Test (Wilcoxon Rank-Sum Test), Wilcoxon Signed-Rank Test (Testing Differences for Paired Data), Kruskal- Wallis H Test (Testing for Differences Between More Than Two Independent Groups), Chi- Square Test for Goodness of Fit (Goodness of Fit Test, Test for Independence, Analyzing Relationships Between Categorical Variables), Friedman Test (Non-Parametric Test for Comparing More Than Two Related Groups).

UNIT- V CORRELATION AND REGRESSION 9

Introduction to Correlation and Regression, Correlation Analysis - Pearson's Correlation Coefficient (r), Spearman's Rank Correlation. Simple Linear Regression - Introduction to Regression Analysis, Simple Linear Model, Multiple Linear Regression, Applications of Correlation and Regression in Engineering - Quality Control and Six Sigma, Reliability Engineering, Optimization Problems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

1. Students will be able to facilitate objective solutions in business decision making.
2. Students will understand and solve business problems.
3. Students will apply statistical techniques to data sets, and correctly interpret the results.
4. Students will develop skill-set that is in demand in both the research and

business environments.

5. Students will be able to apply the statistical techniques in a work setting.

REFERENCE BOOKS:

1. Richard I. Levin, David S. Rubin, Masood H Siddiqui, Sanjay Rastogi, Statistics for Management, Pearson Education, 8th Edition, 2017.
2. Fundamentals of Mathematical Statistics, by S.C. Gupta and V.K. Kapoor Revised Edition 2020.
3. Prem. S. Mann, Introductory Statistics, Wiley Publications, 9th Edition, 2015.
4. T N Srivastava and Shailaja Rego, Statistics for Management, Tata McGraw Hill, 3rd Edition 2017.
5. Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.

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| BAM402 | DATA MINING FOR BUSINESS INTELLIGENCE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To familiarize students with the fundamental principles and scope of datamining and business intelligence.
- To develop an understanding of data preparation and data quality issues in business analytics.
- To explain key datamining techniques such as classification, clustering, and association rule mining from a business view point.
- To expose students to the practical applications of datamining in various business functions.
- To sensitize students to the ethical, strategic and managerial implications of using datamining for decision-making.

UNIT- I INTRODUCTION TO DATAMINING AND BUSINESS INTELLIGENCE 9

Data Mining – Definition – Purpose – Role in Business Intelligence – Scope – Importance in Managerial Decision-Making – Difference between Data Mining and Business Analytics – Knowledge Discovery in Databases (KDD) – CRISP – DM Methodology – Phases of Data Mining Process – Applications in Business – Benefits and Limitations – Organizational Challenges in Data Mining Implementation.

UNIT- II DATA PREPARATION AND DATA UNDERSTANDING 9

Types and Sources of Business Data – Structured and Unstructured Data– Importance of Data Quality – Data Cleaning and Handling Missing Values – Data Normalization and Transformation – Exploratory Data Analysis (EDA) – Descriptive Statistics – Frequency Distributions–Data Visualization Techniques–Graphs and Charts–Use of Dashboards for Business Insights – Role of EDA in Business Decision-Making.

functional business problems.

5. Students will be able to evaluate the role of ethics, managerial insight and business context in the implementation of data-driven strategies.

REFERENCE BOOKS:

1. Galit Shmueli, Nitin R. Patel, and Peter C. Bruce, Data Mining for Business Analytics: Concepts, Techniques, and Applications with XL Miner, 3rd Edition, 2016, Wiley.
2. U Dinesh Kumar, Business Analytics: The Science of Data – Driven Decision Making, 2nd Edition, 2020, Wiley India Pvt. Ltd.
3. V. Ramesh and K.N. Prasad, Data Mining and Data Warehousing, 2nd Edition, 2020, Wiley India Pvt. Ltd.
4. V.P Jain, Data Mining Techniques for Marketing, Sales, and Customer Relationship Management, 1st Edition, 2016, BPB Publications.
5. Anil Maheshwari, Data Analytics Made Accessible, 2nd Edition, 2017, Amazon Digital Services LLC.

OBJECTIVES:

- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common work force issues and resolving the musing people analytics.
- The learners will be conversant about HR metrics and ready to apply at work settings.

UNIT- I INTRODUCTION TO HR ANALYTICS 9

HR analytics - People Analytics: Definition- context - stages of maturity - Human Capital in the Value Chain: impact on business. HR Analytics vs HR Metrics – HR metrics and KPIs.

UNIT- II HR ANALYTICS I: RECRUITMENT 9

Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire- Recruitment to HR cost - Recruitment analysis.

UNIT- III HR ANALYTICS II: TRAINING AND DEVELOPMENT 9

Training & Development Metrics: Percentage of employee trained- Internally and externally trained-Training hours and cost per employee - ROI -Optimising the ROI of HR Programs - Training and Development analysis.

UNIT- IV HR ANALYTICS III: EMPLOYEE ENGAGEMENT AND 9 CAREER PROGRESSION

Employee Engagement Metrics: Talent Retention - Retention index - Voluntary and involuntary turnover- Turnover by department, grades, performance, and service tenure - Internal hired index - Engagement Survey Analysis. Career Progression Metrics : Promotion index - Rotation index - Career path index - Level wise succession readiness index.

UNIT- V HR ANALYTICS IV: WORK FORCE DIVERSITY AND 9 DEVELOPMENT

Workforce Diversity and Development Metrics: Employees per manager - Workforce age profiling - Workforce service profiling- Churn over index - Workforce diversity index - Gender mix - Differently abled index- Revenue per employee – Operating cost per employee - PBT per employee - HR cost per employee- HR budget variance - Compensation to HR cost.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will be conversant about HR metrics and ready to apply at work settings.
2. Students will be able to resolve HR issues using people analytics.
3. Students will gain knowledge about analytics of training and development.
4. Students will know about the analytics of employee engagement and career progression
5. Students are competent in the analytics of work force diversity and development.

REFERENCE BOOKS:

1. Ferrar, J., & Green, D. Excellence in People Analytics: How to Use Data to Create Value and Drive Business Success (2nd ed.). Kogan Page. 2021.
2. Soundararajan, R., & Singh, K. Winning on HR Analytics: Leveraging Data for

Competitive Advantage. SAGE Publications Pvt. Ltd. 2022.

3. Edwards, M. R., Minbaeva, D., Levenson, A., & Huselid, M. A. (Eds.). *Workforce Analytics: A Global Perspective*. Routledge. 2023.
4. Jang, D., Edwards, M., & Edwards, K. *Using R in HR Analytics*. Kogan Page 2023.
5. Lochab, A., Duhan, P., & Dangi, H.K. *HR Analytics: Concepts and Applications*. S. Chand Publishing. 2025.

UNIT- IV WEB ANALYTICS**9**

Web Analytics—Present and Future—Data Collection—Importance and Options, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of A Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis.

UNIT- V SEARCH ANALYTICS**9**

Search Engine Optimization (SEO), User Engagement, User-Generated Content, Web Traffic Analysis, Navigation, Usability, Eye Tracking, Online Security and Ethics, Content Management System, Data Visualization. RSS Feeds, Mobile Platforms, Understanding Search Behaviors.

TOTAL : 45 PERIODS**COURSE OUTCOMES:**

1. The students will understand Marketing in Social Media, Web, and Social Media Analytics and their Potential Impact.
2. The students will be able to enhance their social media marketing skills.
3. The students can develop a mass communication strategy and guide marketing campaigns.
4. The students will understand the fundamentals and concepts of web analytics.
5. The students will learn to use the resulting insights effectively to support website design decisions, campaign optimisation, search analytics, etc.

REFERENCE BOOKS:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013.
2. Christian Fuchs, Social Media: A Critical Introduction, Sage Publications Ltd, 2014.
3. Bittu Kumar, Social Networking, V & S Publishers, 2013.
4. Avinash Kaushik, Web Analytics - An Hour A Day, Wiley Publishing, 2007.
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and Cafepress 2004.

| | | | | | |
|---------------|-----------------------------------|----------|----------|----------|----------|
| BAM405 | OPERATION AND SUPPLY CHAIN | L | T | P | C |
| | ANALYTICS | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To introduce students to the foundational concepts of analytics and their strategic role in transforming supply chains using descriptive, predictive, and prescriptive methods.
- To equip learners with quantitative tools for warehousing decisions, including mathematical programming and heuristic methods for facility layout and space optimization.
- To develop an in-depth understanding of inventory management techniques, emphasizing risk analysis, aggregation models, and multi-echelon planning.
- To provide analytical skills to model and solve complex transportation and distribution network problems using graph theory, flow models, and routing algorithms.
- To enable application of Multi-Criteria Decision-Making (MCDM) techniques such as AHP, DEA, and TOPSIS in supply chain decision scenarios.

UNIT- I INTRODUCTION 9

Introduction to analytics – descriptive, predictive, and prescriptive analytics, Data-driven supply chains, Road map for data-driven supply chains. Transforming supply chains, Barriers to implementation of supply chain strategies.

UNIT- II WAREHOUSING DECISIONS 9

Mathematical programming models - P-median methods - Guided LP approach – Balmer –Wolfe method, Greedy drop heuristics, Dynamic location models, Space determination and layout methods.

UNIT- III INVENTORY MANAGEMENT 9

Inventory aggregation models - Dynamic lot sizing methods, Multi-echelon inventory

REFERENCE BOOKS:

1. Nada R. Sanders, Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence, Pearson Education, 2014.
2. Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain, Pearson Education, 2013.
3. Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, Networks Against Time: Supply Chain Analytics for Perishable Products, Springer, 2013.
4. Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, Analytics in Operations/Supply Chain Management , I.K. International Publishing House Pvt. Ltd., 2016.
5. Gerhard J. Plenert, Supply Chain Optimization through Segmentation and Analytics, CRC Press, Taylor & Francis Group, 2014.

OBJECTIVES:

- To introduce fundamental financial concepts and decision-making techniques relevant to corporate finance.
- To familiarize students with the basics of financial markets and time-series analysis techniques for estimating risk and return.
- To provide insights into portfolio theory and option pricing models used for investment analysis.
- To expose students to basic technical indicators and simulation strategies for analyzing stock market behavior.
- To enable students to understand and apply basic credit risk models using statistical and machine learning techniques.

UNIT- I FOUNDATIONS OF CORPORATE FINANCIAL ANALYSIS 9

Introduction to financial analytics. Basic financial models – Time value of money, cash flow analysis, cost of capital. Project appraisal methods – Payback period, NPV, IRR. Capital budgeting and financial break-even analysis.

UNIT- II FINANCIAL MARKET DATA AND TIME-SERIES ANALYSIS 9

Introduction to financial market instruments – Stocks and Bonds. Basics of risk and return. Overview of financial data and Time-Series characteristics. Introduction to Value at Risk (VaR). Basics of Auto Regressive Moving Average (ARMA), Autoregressive Conditional Heteroscedasticity (ARCH), and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models for volatility forecasting.

UNIT- III PORTFOLIO THEORY AND DERIVATIVES 9

Portfolio diversification and risk-return trade-off. Capital Asset Pricing Model (CAPM). Sharpe ratio. Option pricing basics – Binomial model, Black-Scholes

model. Implied volatility and option strategies.

UNIT- IV TECHNICAL ANALYSIS AND TRADING SIMULATIONS 9

Overview of technical indicators – Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Rate of Change (ROC), Moving Averages, Candlestick patterns. Simulation of basic trading strategies. Introduction to algorithmic trading concepts. Prediction of stock prices using chart patterns.

UNIT- V CREDIT RISK ANALYTICS 9

Introduction to credit risk. Data pre-processing for credit modelling. Logistic regression, decision trees, and model evaluation techniques. Application of analytics in credit scoring and loan approvals, and evaluating credit risk model.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

1. Students will apply core financial concepts to evaluate corporate investment decisions using tools like NPV and IRR.
2. Students will analyze risk and return using financial time-series models and interpret key market indicators.
3. Students can able to construct and assess investment portfolios and derivative strategies using theoretical models.
4. Students will use basic technical analysis indicators and simulate simple trading strategies.
5. Students can develop and evaluate credit risk models using statistical methods like logistic regression and decision trees.

REFERENCE BOOKS:

1. Mark J. Bennett, Dirk L. Hugen, "Financial Analytics with R: Building a Laptop Laboratory for Data Science", Cambridge University Press, 1st Edition, 2016.
2. Pavel Ryzhov, "Haskell Financial Data Modeling and Predictive Analytics", Packt Publishing, 1st Edition, 2013.

3. Edward E. Williams, John A. Dobelman, "Quantitative Financial Analytics: The Path to Investment Profits", World Scientific Publishing, 1st Edition, 2017.
4. Yuxing Yan, "Python for Finance – Second Edition: Apply Powerful Finance Models and Quantitative Analysis with Python", Packt Publishing, 2nd Edition, 2017.
5. James Ma Weiming, "Mastering Python for Finance – Second Edition: Implement Advanced State-of-the-Art Financial Statistical Applications Using Python", Packt Publishing, 2nd Edition, 2019

Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC — Case studies.

UNIT- V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE 9
PROJECTS

Case Studies - Sustainable projects in developed countries and developing nations
- An Integrated Framework for Successful Infrastructure Planning and Management
- Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. — Use of Emerging Technologies — IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance .

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Understand the environment sustainability goals at global and Indian scenario.
2. Understand risks in development of projects and suggest mitigation measures.
3. Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
4. Explain Life Cycle Analysis and life cycle cost of construction materials.
5. Explain the new technologies for maintenance of infrastructure projects.

TEXTBOOKS:

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques

(3e), Yesdee Publication Pvt. Ltd, 2016.

5. New Building Materials and Construction World magazine

REFERENCE BOOKS:

1. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press.
2. Munier N, "Introduction to Sustainability", Springer 2005.
3. Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
4. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing,2009
5. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union;2010

| AGM501 | PO | | | | | | | | | | | | PSO | | | |
|----------------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | 1 | 1 | - | 2 | 3 | 1 | 1 | - | 2 | 1 | 1 | 2 | 1 | - |
| CO2 | 3 | 1 | 3 | 2 | 1 | 2 | 2 | - | 1 | 1 | 1 | 2 | 2 | 2 | 2 | - |
| CO3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | - | - | - | 1 | 1 | 1 | 3 | 1 | - |
| CO4 | 3 | 1 | 3 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | - |
| CO5 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 1 | - | 1 | 1 | 2 | 2 | 3 | 2 | - |
| Average | 3 | 1 | 3 | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | - |

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| AGM502 | SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To educate the students about the issues of sustainability in agroecosystems,
- To introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.
- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.
- To introduce the students about the importance of the land and water resources in India.
- To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.

UNIT- I AGROECOLOGY , AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS 9

Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems.

UNIT- II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT 9

Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control.

converting to a sustainable system through the redesign of a conventional agroecosystem

TEXTBOOKS:

1. Approaches to Sustainable Agriculture — Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
2. M.Lakshmi Narasaiah, Environment and Agriculture, Discovery Pub. House, 2006.
3. Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005.
4. Saroja Raman, “Agricultural Sustainability – Principles, Processes and Prospects”, CRC Press, 2013.
5. Prof Johannes S. C. Wiskerke, Dr Nevin Cohen, Dr Laine Young, Prof Alison Blay-Palmer, Achieving sustainable urban agriculture, 2020.

REFERENCE BOOKS:

1. Agricultural Economics and Agribusiness, Cramer, Jensen, and Southgate, John Wiley.
2. Agricultural Economics, Drummond and Goodwin, Prentice Hall.
3. T.C. Byerly, Environment and Agriculture, United States Dept. of Agriculture, Economic Research Service, 2006.
4. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer, 2020
5. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016.

| AGM502 | PO | | | | | | | | | | | | PSO | | | |
|---------|----|---|---|---|---|---|---|---|---|----|----|----|-----|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | - | 2 | - | - | - | - | - | 2 | - | 2 | - | - | 2 | 2 | - | - |
| CO2 | - | 2 | - | 2 | 2 | 2 | - | - | - | - | - | - | 3 | 2 | - | - |
| CO3 | - | - | - | 2 | | 2 | - | - | - | - | - | - | 3 | 2 | 3 | - |
| CO4 | 3 | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 2 | - | 3 | 2 | 3 | - |
| CO5 | - | 2 | 3 | 2 | - | - | 1 | - | - | - | - | 1 | - | 2 | - | - |
| Average | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 3 | - |

OBJECTIVES:

- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.

UNIT- I INTRODUCTION TO BIOMATERIALS**9**

Introduction: Definition of biomaterials, requirements & classification of biomaterials- Types of Biomaterials- Degradable and resorbable biomaterials- engineered natural materials- Biocompatibility-Hydrogels-pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types- crystal structure- imperfection in crystalline structure-surface properties and adhesion of materials – strength of biological tissues-performance of implants-tissue response to implants- Impact and Future of Biomaterials

UNIT- II BIO POLYMERS**9**

Molecular structure of polymers -Molecular weight - Types of polymerization techniques–Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Polymethylmethacrylate (PMMA- Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers –Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications.

UNIT- III BIO CERAMICS AND BIOCOMPOSITES 9

General properties- Bio ceramics -Silicate glass - Alumina (Al_2O_3) -Zirconia (ZrO_2)- Carbon- Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites- Polymer Matrix Composite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)– glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT- IV METALS AS BIOMATERIALS 9

Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys - Titanium alloys- Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration- medical application-corrosion of metallic implants — biological tolerance of implant metals

UNIT- V NANOBIMATERIALS 9

Steel construction, Types of steel used for construction, Methods of utilizing steel construction, Advantages and Applications of steel in construction.

Advanced Materials: Adhesives in construction industry-Acrylics, Bridge bearings, Industrial waste materials in concrete Rapid wall panels, Moisture Barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will gain familiarity with Biomaterials and they will understand their importance.
2. Students will get an overview of different biopolymers and their properties
3. Students gain knowledge on some of the important Bioceramics and Biocomposite materials
4. Students gain knowledge on metals as biomaterials
5. Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

TEXTBOOKS:

1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani “Introduction to Biomaterials Basic Theory with Engineering Applications” Cambridge University Press, 2014.
2. Donglu shi “Introduction to Biomaterials” Tsinghua University press, 2006.
3. Joon Park, R.S.Lakes “Biomaterials An Introduction” third edition, Springer 2007.
4. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh “Characterization of Biomaterials” Wood head publishing, 2013.
5. Buddy D.Ratner and Allan S.Hoffman Biomaterials Science “An Introduction to Material in Medicine” Third Edition, 2013.

REFERENCE BOOKS:

1. Vasif Hasirci, Nesrin Hasirci “Fundamentals of Biomaterials” Springer, 2018
2. Leopido Javier Rios Gonzalez. “Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process” Apple academic press, 2021.
3. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad “Functional Bionanomaterials” springer, 2020.
4. Sujata.V.Bhat Biomaterials; Narosa Publishing house, 2002.
5. VasifHasirci, NesrinHasirci “Fundamentals of Biomaterials” Springer, 2018

| AGM503 | PO | | | | | | | | | | | | PSO | | | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 3 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | 1 | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 1 | - | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| Average | 2.2 | 1.8 | 1.8 | | 1.7 | 1 | - | - | - | - | - | - | - | - | - | - |

AGM504

**MATERIALS FOR ENERGY
SUSTAINABILITY**

**L T P C
3 0 0 3**

OBJECTIVES:

- To familiarize the students about the challenges and demands of energy sustainability.
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell.
- To enable students to appreciate novel materials and their usage in photovoltaic application.
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT- I SUSTAINABLE ENERGY SOURCES 9

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy.

UNIT- II ELECTROCHEMICAL DEVICES 9

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O₂ battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO₂, LiFePO₄, LiMn₂O₄) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based).

UNIT- III FUEL CELLS 9

Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells,

phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) — Thermodynamics of fuel cell — Fuel utilization — electrolyte membrane (proton conducting and anion conducting) — Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) — Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates).

UNIT- IV PHOTOVOLTAICS 9

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells – thin film silicon solar cells – multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se₂ solar cells – Cadmium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells - Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials - copper-phthalocyanine and perylenetetracarboxylicbis - benzene – fullerenes - boron subphthalocyanine- tin (II) phthalocyanine)

UNIT- V SUPERCAPACITORS 9

Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance — electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite- conductive polypyrrole hydrogels — Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two - Dimensional (2D) Electrode Materials - 2D transition metal carbides,

carbonitrides, and nitrides.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

1. Students will acquire knowledge about energy sustainability and principles of different electrochemical devices and working of fuel cells and their application.
2. The students gain knowledge on different types of supercapacitors and the performance of various materials.
3. Comprehend and learn concepts related to building automation hardware and software and their application in smart buildings
4. Examine and apply lighting control, air conditioning and related applications in the context of smart buildings
5. Assess and apply other critical smart building applications and appreciate the role of data analytics in the control of building systems

TEXTBOOKS:

1. Functional materials for sustainable energy applications; John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards.
2. Hand Book of Fuel Cells: Fuel Cell Technology and Applications, Wolf Vielstich, Arnold Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, Wiley, London 2003.
3. B.E. Conway, Electrochemical supercapacitors: scientific fundamentals and technological applications, Kluwer Academic / Plenum publishers, New York, 1999.
4. T.R. Crompton, Batteries reference book, Newners, 3rd Edition, 2002.
5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh

REFERENCE BOOKS:

1. Electrode Materials for Supercapacitors: A Review of Recent Advances, Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai, catalysts 2020.
2. Recent advances, practical challenges, and perspectives of intermediate

temperature solid oxide fuel cell cathodes Amanda Ndubuisi, Sara Abouali, Kalpana Singh and VenkataramanThangadurai, J. Mater. Chem. A, 2022.

3. Review of next generation photovoltaic solar cell technology and comparative materialistic development Neeraj Kant, Pushpendra Singh, Materials Today: Proceedings, 2022.
4. Raphael, B. (2022). Construction and Building Automation: From Concepts to Implementation. Routledge.
5. Sinopoli, J. M. (2009). Smart buildings systems for architects, owners and builders. Butterworth-Heinemann.

| AGM504 | PO | | | | | | | | | | | | PSO | | | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | - | - | - | - | - | 3 | - | - | - | - | - | 2 | - | - | - |
| CO2 | 1 | - | - | - | - | - | - | - | 1 | - | - | 2 | - | 3 | 1 | - |
| CO3 | - | - | - | 3 | | 1 | 2 | - | - | - | - | - | - | 2 | - | 2 |
| CO4 | - | - | - | - | - | - | - | 1 | - | - | 3 | - | 1 | - | 2 | - |
| CO5 | - | - | - | - | - | 1 | 1 | 3 | 2 | - | - | 2 | - | - | - | - |
| Average | 1.5 | - | - | 3 | - | 1 | 2 | 2 | 1.5 | - | 3 | 2 | 1.5 | 2.5 | 1.5 | 2 |

REFERENCE BOOKS:

1. Ritu Dogra, "Renewable Energy and Green Technology", Brillion Publishing, 2023.
2. Green chemistry metrics - Alexi Lapkin and david Constable (Eds) ,Wiley publications,2008
3. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017
4. Green technology and design for the environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, Washington, DC, ©1997
5. Sambit Kumar Mishra, Zdzislaw Polkowski, Samarjeet Borah, Ritesh Dash, "AI in Manufacturing and Green Technology: Methods and Applications" CRC Press, 2021.

| AGM505 | PO | | | | | | | | | | | | PSO | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|---|---|-----|----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | - | - | - | 1 | 2 | - | - | - | 3 | - | 2 | 1 | 1 | 2 | - |
| CO2 | 1 | 2 | - | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 1 | - | 2 | - |
| CO3 | 1 | 2 | 2 | 2 | 1 | 2 | - | - | - | 2 | - | 2 | 2 | - | 2 | - |
| CO4 | 1 | 2 | 2 | 3 | 2 | 2 | - | - | - | 3 | - | 3 | 1 | 1 | 2 | 1 |
| CO5 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | - | - | 3 | - | 3 | 1 | 1 | 2 | - |
| Average | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | 0 | 0 | 3.0 | 0 | 2.0 | 1.0 | 1.0 | 2.0 | 1.0 |

| | | | | | |
|---------------|--|----------|----------|----------|----------|
| AGM506 | ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.
- To know the analytical and instrumental methods to measure various IEQ parameters
- To familiarize the regulations, standards and guidelines of IEQ
- To learn the fundamentals of computational fluid dynamics (CFD)

UNIT- I ENVIRONMENTAL MONITORING AND STANDARDS 9

Introduction to indoor environmental quality – Parameters: Thermal Comfort - thermal balance of human body – instrumentation and measurement - impact of thermal comfort on human productivity and health.

UNIT- II MONITORING OF ENVIRONMENTAL PARAMETERS 9

Current Environmental Issues- Global Environmental monitoring programme- International conventions- Application of Environmental Monitoring- Atmospheric Monitoring - screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air-sampling of flue gas.

UNIT- III ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING 9

Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling

techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT- IV ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT 9

Water quality monitoring programme- national water quality monitoring- Parameters for National Water Quality Monitoring- monitoring protocol; Process of risk assessment- hazard identification- exposure assessment- dose-response assessment; risk characterization.

UNIT- V AUTOMATED DATA ACQUISITION AND PROCESSING 9

Fundamentals of mass transport – definition of intraphase and inter-phase chemical flux; interphase mass transport, diffusion coefficient and convection mass transfer coefficients. Chemical Exchange between air-water Overall transport model and scenarios.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students will know

1. Basic concepts of environmental standards and monitoring.
2. The ambient air quality and water quality standards;
3. The various instrumental methods and their principles for environmental monitoring.
4. The significance of environmental standards in monitoring quality and sustainability of the environment.
5. The various ways of raising environmental awareness among the people.

TEXTBOOKS:

1. Environmental monitoring Handbook, Frank R. Burden, © 2002 by The McGraw-Hill Companies, Inc.
2. Handbook of environmental analysis: chemical pollutants in the air, water,

soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc.

3. Pengler, J.D.; McCarthy, J.F.; Same, J.M., Indoor Air Quality Handbook. McGraw Hill, 2000.
4. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.
5. Daoliang Li, Shuangyin Liu, "Water Quality Monitoring and Management" Elsevier, 2018.

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1. Nazaroff, W.W., and Alvarez-Cohen, L., Environmental Engineering Science. Wiley sons, Newyork, 2001.
2. H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, CBP Publishers and Distributors, New Delhi, 1988.
3. Maroni, M.; Seifert, B.; Lindvall, T., Indoor Air Quality: A Comprehensive Reference Book. Elsevier Science Ltd, 1996.
4. Heaslip, G. (1975) Environmental Data Handling. John Wiley & Sons. New York.
5. Nicolas Mazzeo, "Air Quality Monitoring, Assessment and Management", IntechOpen.

| AGM506 | PO | | | | | | | | | | | | PSO | | | |
|----------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 1 | 2 | - | - | - | 2 | - | 2 | - | 3 | - | 2 | 1 | - | - | 1 |
| CO2 | - | 1 | - | 2 | - | 2 | - | 2 | - | 2 | - | 2 | 1 | - | - | 1 |
| CO3 | - | - | 2 | 2 | - | 2 | - | 2 | - | 2 | - | 2 | - | 2 | - | 1 |
| CO4 | - | - | 2 | 3 | - | 2 | - | 3 | - | 3 | - | 3 | 1 | 1 | - | 1 |
| CO5 | - | - | 2 | 2 | - | 2 | 3 | 2 | - | 3 | - | 3 | - | 1 | - | 1 |
| Average | 1.0 | 2.0 | 2.0 | 2.0 | 0.0 | 2.0 | 3.0 | 2.0 | 0.0 | 3.0 | 0.0 | 2.0 | 1.0 | 1.0 | 0.0 | 1.0 |